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GENERAL

6011 The So-called Superbomb. Ulrich Jetter. Physik. Blätter 6, 199-205(1950)(in German).

Speculations are made on the probable nature of the hydrogen bomb. The most plausible reaction cycle is $Li^6 + n \rightarrow He^4 + t$, $t + d = He^4 + n$. A supply of n or t, or both, is presumably needed; the former, apart from the accompanying plutonium bomb, could be furnished by the reaction $Be^9(n,2n)$. The direct process $Li^6 + d \rightarrow 2He^4$, as well as $Li^7 + p \rightarrow 2He^4$, needs higher temperatures than that developed by the plutonium bomb.

6012 Contribution to the Study of the Prospects of the Utilization of Atomic Energy in Argentina. H. Freimuth. Rev. inst. nacl. invest. cienc. nat., cienc. geol. 1, 1-64(1949)(in Spanish).

A summary of the fundamentals of nuclear physics and of fission reactors is followed by statistics of the world's sources of industrial energy and by some speculations on the future uses of atomic energy in Argentina.

6013 How Soon? Atomic Electric Power. Herbert Bratter. Public Utilities 46, 276-86(1950) Aug. 31.

A general, nontechnical discussion is presented of problems, such as availability of material, military needs, power plant construction difficulties, waste disposal, capital and operating costs, and limitations on energy distribution, that must be solved before commercial power becomes available from nuclear reactors.

6014 Man's Use of Energy. Harold Hartley. Nature 166, 368-76(1950) Sept. 2.

The Presidential Address delivered before the August 30, 1950, meeting of the British Association presents an illuminating history of the ever-increasing use of energy and discusses the present world energy consumption and resources, and the possibility of new sources of power, including nuclear energy.

6015 Atomic Energy Development in Canada. David A. Keys. Atomics (London) 1, 262-5(1950) Sept.

The major atomic energy project in Canada, operated by the National Research Council for the Atomic Energy Control Board, is at Chalk River, where there are two heavy water reactors in operation, a small experimental one of a few watts output, and a large pile having a maximum flux density of neutrons of $5.7 \times 10^{13}/cm^2/sec$. This latter reactor is specially designed for research with particular devices for irradiating materials for the production of radioisotopes, and for providing beams of neutrons for experimental purposes. There are special laboratories for nuclear and technical physics, chemical and chemical engineering research, biological and medical investigations, as well as chemical separation and isotope-production branches. A description of the laboratories and reference to a special electronics branch is included. (auth)

BIOLOGY AND MEDICINE

6016 Cancer Research in Several British and European Laboratories. Dan H. Moore. Office of Naval Research London Technical Report ONRL-54-50, May 17, 1950. 41p.

Some of the investigations in cancer research in progress at the Chester Beatty Research Institute, London; Leeds University; Royal Cancer Hosptial, Glasgow; Netherlands Cancer Institute, Amsterdam; Cancer Research Institute, Heidelberg; and other institutions are described. Information on these activities has been obtained from reports at meetings, recent literature, or direct interviews. The specific topics reported cover a wide latitude of approach to the cancer problem.

BIOLOGY AND MEDICINE

6017 Determination of the LD_{50} by Use of Probit, Angular, and Logit Transformations. Sylvanus A. Tyler and Joan Gurian. ANL-4486, Mar. 1950. 22p.

Calculation of LD_{50} from x-ray mortality data is carried through by three methods of statistical analysis. Suitable transformations are performed on the proportion P of deaths at each dosage by (1) treatment of the probits, or normal deviates of P, on the basis of an integrated normal curve, (2) transformation of P to an angle, and (3) use of the logistic "growth function" as an approximation to the curve in (1). The results for LD_{50} are in close agreement (559.53, 561.15, and 559.79 r, respectively), but the first method is considered best for the analysis of such response data.

6018 Hematological Effects of Ionizing Radiations. VII. Progress Report Apr. 1, 1949–Feb. 28, 1950. B. V. A. Low-Beer and Paul M. Aggeler. UCRL-862, nd. 87p.

The progress made in the study of hematological effects of total-body irradiation during the period from Apr. 1, 1949, to Feb. 28, 1950 is reported. The purpose of this investigation is the observation of morphological changes which become evident in the peripheral blood of patients following exposure to therapeutic doses of ionizing radiations. Patients who have been followed hematologically include one group treated with 100-, 200-, or 1000-kv x-rays who had been exposed to total accumulated body doses of 100 to 390 r as measured on the skin; a group treated with radiophosphorus, P^{32}, for advanced generalized arthritis who had received intravenously total doses of 3600 to 8000 μc; and a group who had been orally administered radioiodine, I^{131}, in amounts varying from a few hundred to 100,000 μc for Grave's disease. Dose-effect relations are analyzed.

6019 The Distribution of Phosphatases in the Rabbit Appendix after X-irradiation. William L. Doyle. Am. J. Anat. 87, 79-117(1950) July.

Staining reactions and quantitative determinations of the acid and alkaline phosphatase content of the cells of the rabbit appendix at various levels from the mucosa to the muscularis are presented for the normal animal and for rabbits irradiated with a total-body dose of 625 r of penetrating x-rays. 29 figures. 12 references.

6020 Dosimetry of Ionizing Particles. G. Failla and H. H. Rossi. Am. J. Roentgenol. Radium Therapy 64, 489-91(1950) Sept.

The problems of preparing tissue-equivalent gas and tissue-equivalent solid in the dosage measurement of both low-energy and high-energy charged particles and neutrons are discussed in general terms. A mixture of water, gelatine, glycerin, and sucrose, gelled by 0.5% formaldehyde, is suggested as a tissue-equivalent solid. Calibration methods are given.

BIOLOGY AND MEDICINE

6021 Effects of X-rays Produced at 50 Kilovolts on Different Species of Bacteria. Harvey Fram, Bernard E. Proctor, and Cecil G. Dunn. J. Bact. 60, 263-7 (1950) Sept.

The effects of irradiation with x-rays produced at 50 kv were studied with six bacteria, Escherichia coli, Aerobacter aerogenes, Staphylococcus aureus, Serratia marcescens, Pseudomonas aeruginosa, and Pseudomonas fluorescens. The rate of destruction followed a first-order reaction. The "37% dose" for each species of bacteria was calculated. S. aureus was found to be the most radioresistant of those studied. The percentage of bacteria of a given species killed by a specific total dosage of x-rays was the same regardless of the initial concentration of bacteria in the suspension irradiated. These results indicate that the bacteria were destroyed by soft x-rays according to the "direct hit" theory of radiation. (auth)

6022 The Immediate Action of X-rays on the Chondriosomes and Lacunomes of the Intestinal Epithelium. Antonietta Guardabassi. Atti accad. nazl. Lincei, Classe sci. fis. mat. e nat. 7, 334-8(1949) Dec. (in Italian).

Corti (Riv. biol. 39(1947)) has recognized in the lacunomes a normal cytological constituent of the intestinal-epithelium cells and has studied their resistivity toward various physicochemical agents, as compared with that of the chondriosomes. The present author extended this comparative study by investigating the alterations produced by x-rays in the two cell components. Rats and mice were irradiatiated with doses ranging from 150 to 900 r. They were then killed and their intestines were fixed at various intervals after the treatment (2 to 8 hr). It was observed that cytoplasmic elements underwent modifications more readily than the nuclear ones and that the length of the interval between the treatment and the tissue fixation affected the frequency of an alteration, but not its character. As in the case of other agents (starvation, heat, cold, pilocarpine), lacunomes showed more resistance against the destructive action of x-rays (swelling, disintegration, disappearance) than did chondriosomes. Unlike other agents, the irradiation seems to strike only some of histologically similar cells, leaving their neighbors intact.

6023 Inhibition of Growth and the Production of Oedema by X-irradiation. Roberts Rugh. J. Exptl. Zool. 114, 137-57(1950) June.

Incidental to studies on the histopathological effects of x-rays on the early frog (Rana pipiens) embryo, it was discovered that at certain stages of development and certain x-ray doses, edema would develop within 24 hr in the majority of cases, and this edema would persist until the death of the embryo. This finding indicated the necessity for trying to determine the exact stage and dose necessary to reproduce the edematous conditions to the maximum extent and the possible origin of the edemas. The results of single exposures to x-irradiation doses of 10,000 to 50,000 r of tadpoles at various stages of development are discussed with respect to the inhibition or stoppage of growth and the production of lordosis (curved back), edema, and other morphological changes. 52 figures.

6024 Penicillin-screened Auxotrophic Mutations in Salmonella Typhimurium and Their Relation to X-ray Dosage. H. H. Plough, Helen N. Young, and Madelon R. Grimm. J. Bact. 60, 145-57(1950) Aug.

Suspensions of S. typhimurium have been exposed to x-radiation up to 57,000 r units and then screened with penicillin on minimal medium containing essential salts and glucose. Of the 457 strains isolated and tested, 234 proved to be auxotrophic mutant strains having a constant requirement for one or more food substances that the parent strain can synthesize for itself. The frequencies of these mutations are directly related to the x-ray dosage, suggesting that they are gene mutations similar to those found in higher organisms. Most of the mutant strains required one of the amino acids or one of the purines, but alternative and multiple requirements were found. The data indicate that at radiation dosages up to 35,000 r a cysteine-requiring mutant is the most numerous, whereas above that level the mutant most frequently isolated requires histidine. A test of the efficacy of the penicillin screening of mixtures of wild-type and x-ray-induced mutations is given. The value of auxotrophic mutations for studies of the steps in bacterial synthetic processes is suggested. (auth)

6025 Thorium-X Investigations: Histological Study of Thorium-X Application on Rabbit Skin. Harold C. Fishman. J. Investigative Dermatol. 15, 71-4(1950) Aug.

The acceptance of thorium X (Ra^{224}) application in the treatment of skin disorders has been slow becuase of the possible radiation danger and the lack of histological studies on effects of the application in animals. The histological changes in the skin of rabbits was therefore investigated. Thorium X in alcoholic solution (1000 electrostatic units/cc) was applied to the barium sulfide-epilated backs of five adult white rabbits, and biopsy specimens were taken weekly for six weeks for histologic comparison with normals. The development of hyperkeratosis, vaculolization of the cytoplasm of the prickle cells, and acanthosis is detailed. The unique skin structure makes rabbits not the best choice as experimental animals for this type of investigation.

6026 X-Ray-Induced Genetic Effects in Germinal and Somatic Tissue of Drosophila Melanogaster. George Lefevre, Jr., Am. Naturalist 84, 341-65(1950) Sept.-Oct.

Attempts were made to induce reverse mutations in both germinal and somatic tissue of Drosophila melanogaster. No evidence of reverse germinal mutation was found following irradiation with 5000 r of some 166,000 recessive X-chromosome loci. In the somatic studies no reverse mutations of white were found in tests equivalent to the exposure of 600,000 white loci to 5000 r. White alleles of three diverse origins were used: (a) spontaneous, (b) x-ray-induced, and (c) mustard-gas-induced. Serious question is thus thrown on the reliability of the early reports of x-ray-induced reverse mutation in Drosophila. The conclusion also was reached that x-ray-induced mutability of the w^+ locus is not significantly affected by the kind of cell in which it is located. A comparison of the influence of various intrinsic and extrinsic factors on x-ray-induced and spontaneous mutation indicates that the two mutation processes are qualitatively different. In all likelihood mutations induced by ionizing radiation in Drosophila, as in maize, are losses or destructions of genetic material; and unlike spontaneous mutations, induced mutations are incapable of further change. 50 references.

BIOLOGY AND MEDICINE

6027 Monthly Report of Laboratory Activities. Health and Safety Division. Merril Eisenbud. NYO-1526, May 1950. 13p.

Brief statements are given of the New York Operations Office Health and Safety Division Laboratory activities for the month of May 1950. This covers the work of the Instruments Branch, Analytical Laboratory, and the laboratory activities of the Radiation Branch. (auth)

6028 Leukemia in Radiologists in a 20-Year Period. Herman C. March. Am. J. Med. Sci. 220, 282-6 (1950) Sept.

The study of the incidence of leukemia in radiologists has been extended to cover a 20-year period. It has been shown that during this time leukemia has occurred more than 9 times as frequently in radiologists as in nonradiological physicians. This difference has statistical significance. It is suggested that the increased incidence of leukemia in physicians as a whole (compared with the adult male white population) might be due to the same factor of exposure to ionizing radiation. The experimental work showing an increased incidence of leukemia in mice exposed to roentgen irradiation has been reviewed. (auth)

6029 List of Respiratory Protective Devices Approved by the Bureau of Mines. S. J. Pearce and L. B. Berger. U. S. Bur. Mines Inform. Circ. 7570, June 1950. 30p.

The self-contained breathing apparatus, gas masks, supplied-air respirators (hose masks, air-line respirators, and abrasive blasting helmets, hoods, or masks), dispersoid (dust, fume, and mist) respirators, and nonemergency gas respirators (chemical cartridge respirators) approved by the Bureau of Mines as of June 1, 1950, are listed and illustrated, and the addresses of manufacturers of approved devices are given.

6030 Potential Biologic Dangers of Nasopharyngeal Beta Irradiation. Isadore Lampe. Trans. Am. Acad. Ophthalmol. Otol. 1950, 502-7 May-June.

The use of monel metal radium applicators in the nasopharynx for the treatment of certain otologic conditions has become widespread. The presumed safety of this form of therapy is questioned. The operator runs the risk of chronic radiodermatitis of the fingers and hands, with possible development of keratoses, chronic painful ulceration, and skin cancer. The patient receives, with the present recommended dosage, far more than the accepted skin erythema dose of 750 r, and the accepted technique of repeated application enhances radiation damage. Delayed formation of chronic ulcers and cancers is possible. The potentiality for progressive latent radiation damage is greatest in children, who unfortunately constitute a large proportion of the patients subjected to this therapy.

6031 Shielding of Skin against Roentgen Radiation by Plastic Compounds. J. Walter Wilson. Arch. Dermatol. and Syphilol. 62, 237-44(1950) Aug.

A plastic, putty-like clay containing 84% bismuth subnitrate and 16% anhydrous wool fat is recommended for shielding the surrounding normal skin while a lesion is being treated by roentgen radiation. This substance is 62% as efficient in stopping radiation as is pure lead; hence a layer one and one-half times as thick is equivalent. For ease in handling, 5 mm is the preferable thickness; this is

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equivalent in shielding efficiency to 3.2 mm of lead. A method of forming a disk of the clay in a compression paddle is described, with details of the manner of using it. Simple pressure of the fingers serves to increase of decrease the size of the opening in relation to the lesion, resulting in easy and accurate adaptation. There is no waste in using this method since the original quantity of clay can be used indefinitely. (auth)

6032 Haemorrhagic Diseases. A. F. Robertson. Bull. Vancouver Med. Assoc. 26, 278-82(1950) Aug.

The diagnosis and treatment of diseases characterized by hemorrhages, including radiation sickness, are briefly discussed.

6033 Detection of Iodine in the Hypophysis with the Aid of I^{131}. A. Ascenzi, G. Boato, and F. Passalacqua. Nuovo cimento 7, 530(1950) July 2 (Letter to the editor, in Italian).

The distribution of iodine in the pituitary gland of guinea pigs was studied by the autoradiographic method. A single dose of I^{131}-labeled NaI was injected (0.3 γ I; 250 μc I^{131}), and the animals were killed 24 hr later. The histological sections of the hypophysis and the thyroid (for control) remained under a Kodak autoradiographic plate for 21 days (hypophysis) or 18 hr (thyroid). The results, which revealed the constant presence of I in the anterior lobe of the hypophysis and its absence from the posterior lobe, are certainly connected with the known correlations between the thyroid and the anterior lobe and with the question on the presence of thyroxin in the pituitary gland. 3 microphotographs.

6034 An Emission Microscope for Photoelectron Autoradiography. A. N. Barker, H. O. W. Richardson, and N. Feather. Research 3, 431-2(1950) Sept. (Correspondence).

Contact autoradiography suffers from 2 disadvantages: (1) limited resolution because the range of the ionizing particles (β rays) in the emulsion is not negligible and (2) unit magnification. This short note gives a brief description of the design and performance of a magnetic lens microscope, with an electron-optical magnification of 7 and a resolution of 6 μ, which is useful when the radioactive source emits electrons of a single energy and when the source can be placed in the gap of a magnetic lens.

6035 The Abuse of Nasopharyngeal Irradiation. Kenneth M. Day. Trans. Am. Acad. Ophthalmol. Otol. 1950, 522-5 May-June.

The primary purpose of nasopharyngeal irradiation by monel metal radium applicators is to reduce and eliminate hyperplastic lymphoid tissue situated in or near the orifices of the eustachian tubes. The presence of this lymphoid tissue has been assumed to be a major cause of tubal obstruction with conductive deafness and high-tone hearing loss, especially prevalent in childhood. The author disagrees with this assumption and maintains that irradiation of the lymphoid tissue will seldom relieve the deafness or cause the tubes to open. Nasal allergy or the presence of masses of adenoids or adhesions following an adenoidectomy are more frequent causes of tubal closure. Irradiation is indicated in only 10% of the cases. The damaging effects of prolonged irradiation are illustrated.

BIOLOGY AND MEDICINE

6036 Assurances as to the Advantages and Safety of Radioactive Iodine Treatment of Hyperthyroidism. Saul Hertz. New Orleans Med. Surg. J. 103, 51-62(1950) Aug.

Over 4000 patients have been treated to date with radioiodine, I^{130} or I^{131}, and the treatment has been shown to be safe, economical of time and money, free of many of the drawbacks of surgical management and antithyroid drug therapy, and virtually 100% efficacious under properly standardized conditions. Patients with serious complications, such as colostomy, congestive heart failure, Addison's disease, renal disease, multiple antecedent operations, and drug sensitivities to iodide and propylthiouracil, as well as patients with severe infections, have responded favorably to I^{131} therapy followed by routine iodinization. Complications of I^{131} therapy are few and mild in character. About 10 patients in 100 develop myxedema. In only one of these is this condition permanent. That myxedema may eventually be entirely avoided seems likely when accuracy of dosage is further improved. None of the once feared aftereffects such as renal damage (radiation nephrosis), sterility, cancer, or genetic damage have appeared, and calculations show that the likelihood of such effects is remote.

6037 The Betatron in Cancer Therapy. H. E. Johns. Nucleonics 7, No. 4, 76-83(1950) Oct.

Recent experience indicates that the high-energy x-ray beam from a 22-Mev betatron offers a practical tool in the treatment of deep-seated cancers. Skin reactions are avoided, and treatment times are short. Experimental arrangements of collimators, shielding, and auxiliaries are shown. Isodose distribution curves for 22-Mev and 400-kv radiation illustrate the greater degree to which concentration at the tumor can be obtained with the former, and the resulting reduction in total energy which the patient must absorb.

6038 Cancer Therapy Regarded as a Production of Lethal Chromosome Mutations in Cancer Cells. Reinhard W. Kaplan. Ärztliche Forsch. 4, 105-16(1950) March 10 (in German).

If cancer tissue can be regarded as a vigorous "new race" of cells, the radiation therapies should be viewed as another mutational process, which in this case is produced by statistically distributed "hits" and consists of gene recombinations that are lethal in the cells' descendants. From this point of view, there exists also a statistical possibility of creating hardy cancerous mutants through the irradiation of normal cells. Consequently, a radiation therapy must be a selective process which, for example, can make use of the different mitosis rates in cancerous and normal tissues. These views are applied to the various types of radiation (x-rays, betatron electrons, neutrons), to ultrasonic waves, and to chemotherapeutical methods (mitosis poisons).

6039 Neurofibrosarcoma of the Neck. Report of Case with Ten Year Survival after Roentgen Therapy. Hirsch Marks. Am. J. Roentgenol. Radium Therapy 64, 470-2(1950) Sept.

Persistent use of roentgen therapy in two courses of treatment with total tumor dosage of 6720 and 3752 r effected a complete cure in this case of neurofibrosarcoma.

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6040 The Primary Cancer-Producing Event in the Light of the Mutation Theory and the "Hit" Principle. Friedrich Hartmut Dost. Ärztliche Forsch. 4, 116-34(1950) Mar. 10 (in German).

The progress of the theory is reviewed which sees in the cancer cell a chromosomal mutant created by various causes, among which are chemical agents and radiations. The "hit" principle, which has proved useful in radiation genetics, can be applied in the domain of cancer inquiry. 144 references.

6041 Pulmonary Metastatic Lesion Successfully Treated with Radioactive Iodine. A. Stone Freedberg, Alvin L. Ureles, Mark F. Lesses, and Samuel L. Gargill. J. Am. Med. Assoc. 144, 16-19(1950) Sept. 2.

A metastatic lesion was demonstrated in the right lung of a 14-yr-old boy 1 yr after a right hemithyroidectomy for papillary adenocarcinoma of the thyroid gland. The uptake of I^{131} in the area of the metastasis following a tracer dose was 4 times that of an uninvolved control area. Two months after the administration of 78 mc of I^{131} the lung lesion had resolved, and there was no observable concentration of radioactive iodine over the thyroid area or over the previous metastatic area. Thyrotoxicosis was not observed, and there were no toxic effects on the kidneys or blood. Two months after the first therapeutic dose, symptoms, signs, and laboratory evidence of myxedema were observed. After two additional doses of radioactive iodine (a total of 137 mc), there was no evidence of localization or concentration of radioactive iodine within the body. At the present time, 12 months after the first therapeutic dose of I^{131} and 7 months after commencement of desiccated-thyroid therapy, he is entirely well. The basal metabolic rate is −17% and the serum cholesterol 238 mg per 100 cc. There is no evidence of metastatic recurrence in the neck, lungs, long bones, skull, or pelvis. (auth)

6042 Response of Carcinoma of the Cervix Uteri to Fractionated Radium and Roentgen Therapy Given Concurrently. Howard B. Hunt. Am. J. Roentgenol. Radium Therapy 64, 446-66(1950) Sept.

Concurrent or alternating consecutive administration of radium and roentgen therapy is shown to build up a more effective biological dosage in the parametria than does roentgen and radium therapy separated by an interval of days. Fractionated application of radium permits more effective distribution of dosage, greater individualization, and fewer complications. The methods of radium placement, a modified colpostat, individualized protection of the radium-irradiated zone against excessive roentgen therapy, and a simple internal pelvimeter and pelvic localizer are described.

6043 Supervoltage Roentgentherapy. R. B. Engelstad. Nord. Med. 43, 107-10(1950) Jan. 20 (in Norwegian).

This is an outline of the development of the supervoltage and multimillion-voltage tumor therapy. The latter are important features of modern cancer treatment; however, none of those new methods present ideal irradiation conditions for any cancer at any depth. Properly used 200-kv therapy can probably cure as many deep-seated cancers as the higher voltages tried to date, but the supervoltage therapy may give a better depth-dose distribution. For electromagnetic radia-

tions, 10 to 15 Mev is possibly the optimal voltage in the treatment of deep-seated tumors. With a beam of fast electrons from a betatron, it seems possible to concentrate the bulk of the radiant energy on the tumor itself. (auth)

6044 Acute and Chronic Toxicity of Some Halogenated Derivatives of Methane and Ethane. David Lester and Leon A. Greenberg. Arch. Ind. Hyg. Occupational Med. 2, 335-44(1950) Sept.

The effects of inhalation of dichlorodifluoromethane (CCl_2F_2), trichlorofluoromethane (CCl_3F), 1,1-difluoroethane (CH_3CHF_2), 1-chloro-1,1-difluoroethane (CH_3CClF_2), 1,1-difluoroethylene ($CH_2=CF_2$), fluoroethylene ($CH_2=CHF$), and 1,1-difluoro-1,2-dibromoethane ($CH_2BrCBrF_2$) have been studied in rats. All the compounds, with the exception of the vinyl and vinylidene fluoride, are anesthetic. 1,1-Difluoroethane, 1-chloro-1,1-difluoroethane, and 1,1-difluoro-1,2-dibromoethane are pulmonary irritants. No damage to the liver was observed from inhalation of these compounds. The toxic effects of the compounds are discussed in relation to their boiling points. (auth)

6045 Pharmacologic Tools in the Study of the Mechanism of Uranium Poisoning. Harold C. Hodge. Arch. Ind. Hyg. Occupational Med. 2, 300-11(1950) Sept.

Some of the highlights of the mechanism of uranium poisoning are presented. When uranium as the uranyl ion enters the body, it is carried in the blood stream partly as a nondiffusible protein complex and partly as a diffusible bicarbonate complex. A substantial part of the uranium is deposited in bone through being exchanged with calcium ions at the surface of the bone mineral; each adsorbed uranyl ion apparently complexes with two adjacent phosphate groups. Most of the uranium is excreted in the urine; however, some of the uranium reacts with the cells lining the renal tubules and injures or kills these cells. With small or moderate doses, the distal portion of the proximal convoluted tubule receives the severest injury. If death ensues, it follows a typical uremia; if the animal survives, cellular regeneration restores much of the kidney tissue and function. A few of the pharmacologic tools that have been brought to bear on this problem are (a) fluorophotometric analysis for uranium, (b) ultrafiltration of bicarbonate complex, (c) protein precipitation, (d) radioisotopes in exchange adsorption studies of bone, (e) radioautographs of kidney, (f) renal clearance studies, (g) histopathology, (h) enzymatic activity in the urine, and (i) cell physiology, particularly the inhibition of metabolism as investigated in enzyme studies and kinetic studies. (auth)

6046 Placental Barrier in Carbon Monoxide, Barbiturate, and Radium Poisoning. Some Original Observations in Humans. Harrison S. Martland and Harrison S. Martland, Jr. Am. J. Surg. 80, 270-9(1950) Sept.

Seventeen children of 10 of the original New Jersey radium-dial painters, born during or subsequent to the time their mothers had ingested radioactive substances, have been examined for the presence of radium deposits in their bodies. Although 7 of the mothers later died of radium poisoning, none of the children show appreciable amounts of radioactivity in excess of 0.01 μg of radium, which is considered to be comparable with the upper limit of normal radioactivity in the human body. Although this does not prove that the gaseous emanations constantly present in the mother's blood do not cross the placental barrier and render the fetus radioactive, should they do so, radioactive deposits in the children would be too small ever to produce harmful results in the children or their descendants. The effect on the fetus of CO and barbituate poisoning of the mother has also been studied.

BIOLOGY AND MEDICINE

6047 Reports on Biological Standards. VI. The Design of Toxicity Tests. W. L. M. Perry. Medical Research Council Special Report Series No. 270. His Majesty's Stationery Office, London, 1950.

Many different tests have from time to time been used for estimating the toxicity of drugs. Although improvements in statistical design have usually been applied when a new drug required biological assay for toxicity, they have not as a rule been applied to the older drugs for which designs were already in use. As a result, there exist a number of unrelated designs of widely differing value. In this report an attempt has been made to relate these designs and to determine their relative value, using the toxicity tests for neoarsphenamine as examples. The aim is to assist those engaged in the design and practise of toxicity tests whose mathematical knowledge may often be inadequate for the more detailed discussions of the subject. The mathematical theory of the statistical work is not discussed, reference being made to other publications. After quantal- and graded-response designs are discussed, it is recommended that toxicity tests should, wherever possible, be based upon a graded-response method; recourse to quantal-response methods is necessary only where the use of a graded response is impracticable.

6048 Review of Literature on Health Hazards of Beryllium and Its Compounds. G. G. Morgis and J. J. Forbes. U. S. Bur. Mines Inform. Circ. 7574, July 1950. 23p.

The greatly diversified and increased uses of beryllium and its compounds in recent years have focused attention on the health hazards incident thereto. The Bureau of Mines has a fundamental interest in safety and the elimination or reduction of health hazards in the mineral and allied industries, and it recognizes that serious hazards are inherent in the production and use of beryllium and its compounds. This circular presents a review of the literature pertaining to such health hazards, but does not describe original research by Bureau personnel. Most of the bibliography has been either quoted in part or abstracted in an effort to present information in a comprehensive and readable form. In reviewing the literature, differences of opinions were recognized in the writings of the respective authors, but no attempt was made to evaluate such differences. This presentation is devoted strictly to reporting without editorial comment. 38 references. (auth)

6049 The Toxicity of Sulfur Hexafluoride. David Lester and Leon A. Greenberg. Arch. Ind. Hyg. Occupational Med. 2, 348-9(1950) Sept.

The effects of inhalation of sulfur hexafluoride have been studied. Rats exposed for many hours to an atmosphere containing 80% sulfur hexafluoride showed no effects. Sulfur hexafluoride appears to be a physiologically inert gas. (auth)

6050 The Toxicity of Sulfur Pentafluoride. Leon A. Greenberg and David Lester. Arch. Ind. Hyg. Occupational Med. 2, 350-2(1950) Sept.

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The toxic effects occurring in rats exposed to sulfur pentafluoride have been studied. In short exposures of 1 hr a concentration of sulfur pentafluoride of 10 ppm causes corrosion of the lungs, 1 ppm causes irritation of the lungs, and 0.1 ppm has no discernible toxic action. In exposures of 16 to 18 hr death occurred at a concentration of 1 ppm, severe lesions of the lungs at a concentration of 0.5 ppm, irritation of the lungs at a concentration of 0.1 ppm, and no discernible effects were present at 0.01 ppm. The injury of the lungs resulting from inhalation of sulfur pentafluoride is explained by hydrolysis of the compound with formation of other compounds. Sulfur pentafluoride is therefore insidiously dangerous and appears to be more toxic than phosgene. (auth)

6051 Toxicity of the Tetrachlorodifluoroethanes. Leon A. Greenberg and David Lester. Arch. Ind. Hyg. Occupational Med. 2, 345-7(1950) Sept.

The tetrachlorodifluoroethanes show no toxicity when fed to rats in a dose of 2 g/kg/day. The vapors of both tetrachlorodifluoroethanes are slightly intoxicating at a concentration of 1.0%, anesthetic at 1.5%, and rapidly fatal at 2.0% and higher in exposures of short duration. The asymmetric compound, 1,1,1,2-tetrachloro-2,2-difluoroethane, does not cause any pulmonary irritation in animals exposed to a concentration of 0.1% for 17 days, or 0.5 or 1.0% for 18 to 21 hr, or 2.0 or 3.0% for shorter periods. The symmetric compound, 1,1,2,2-tetrachloro-1,2-difluoroethane, is a pulmonary irritant at concentrations of 1.0% or more even for short exposures, and at 0.5% it is fatal for an exposure of 18 hr, owing to pulmonary damage. Animals exposed to 0.1% for 16 days did not show any effects. (auth)

6052 The Biological Formation of Formate from Methyl Compounds in Liver Slices. Philip Siekevitz and David M. Greenberg. J. Biol. Chem. 186, 275-86 (1950) Sept.

The oxidation to formate in vivo and in vitro of the labile methyl groups of methionine and choline and of the α-carbon of glycine and β-carbon of serine and also the inhibitory effect of ethionine on this process have been studied with C^{14}-labeled compounds.

6053 The Biosynthesis of Choline Methyl Groups in the Rat. H. R. V. Arnstein. Biochem. J. 47, xviii-xix (1950) Aug.

The reduction of formate and similar potential one-carbon fragments to choline methyl groups has been investigated by feeding d-β-C^{14}-serine, l-β-C^{14}-serine, α-C^{14}-glycine, C^{14}-methanol, sodium C^{14}-formate, carboxyl-C^{14}-glycine, and N^{15}-glycine to adult rats. All these compounds except the carboxyl-labeled glycine gave rise to labeled choline containing the isotope in both the ethanolamine and methyl groups. It is concluded that the one-carbon fragment derived from the β-carbon atom of l-serine and the α-carbon atom of glycine, as well as methanol and formate, can be converted to choline methyl groups by the adult rat. The conversion of glycine to choline takes place through serine, with loss of the carboxyl group.

6054 Biosynthesis of Nucleic Acids in the Mammal. George Bosworth Brown. Federation Proc. 9, 517-23(1950) June.

BIOLOGY AND MEDICINE

A general discussion is presented of recent research, using C^{14}- and N^{15}-labeled adenine, guanine, and other purines and pyrimidines, on the metabolism of the compounds, particularly the larger molecules, which the mammal utilizes for the synthesis of nucleic acids. 54 references.

6055 Chemical Transformations of Carbon in Photosynthesis. M. Calvin, J. A. Bassham, and A. A. Benson. Federation Proc. 9, 524-34(1950) June.

An extended discussion, based on recent research using C^{14} as a tracer, of the reactions and intermediate products involved in photosynthesis is presented. 12 references.

6056 Citric Acid Synthesis by the Condensation of Acetate and Oxalacetate. E. S. Guzman Barron and Guilford G. Rudolph. Minutes of Meetings and Proceedings of the Third Peruvian Congress of Chemistry, 289-95 (1949) Oct. 17-23.

On incubation of rabbit kidney homogenates with C^{14} carboxyl-labeled acetate, oxalacetate, Mg, adenosinetriphosphate, and malonate, there was formation of citric acid labeled with C^{14} in the primary carboxyl carbon. In the absence of malonate there was some C^{14} in the tertiary carboxyl carbon. These experiments demonstrate that the metabolism of acetate starts with its condensation with oxalacetate to form citrate, and is followed by oxidation through the Krebs cycle. The role of ATP is that of rendering labile the H of the CH_3 group of acetate, a process necessary for the condensation. This probably takes place by the formation of an ATP-acetate complex. 28 references. (auth)

6057 Effects of Fasting and Glucose Ingestion on the Retention of Ammonia. Henry D. Hoberman and Jack Graff. J. Biol. Chem. 186, 373-5(1950) Sept.

The effect of fasting and glucose ingestion on the retention of N^{15}-labeled ammonia in the rat has been studied. It is found that the amount of N^{15} excreted by fasting animals receiving isotopic ammonium citrate is more than 50% greater than that excreted by glucose-fed rats. (auth)

6058 The Effect of Salicylates and Adrenocorticotropic Hormone upon the Miscible Pool of Uric Acid in Gout. Jean D. Benedict, Peter H. Forsham, Marcel Roche, Sidney Soloway, and DeWitt Stetten, Jr. J. Clin. Invest. 29, 1104-11(1950) Aug.

The magnitude of the "miscible pool" of uric acid in a patient suffering from severe chronic tophaceous gout has been determined by measurement of the dilution of isotope which occurred when uric acid labeled with N^{15} was injected intravenously. This pool, which increased to a value of about 31 g, or about 30 times normal, fell to a value of about 2 g, or approximately twice normal when the uricosuric doses of acetylsalicylic acid were given. The effect of ACTH upon uric acid metabolism has been studied in both gouty and normal male subjects. The resultant uricosuria appears to arise exclusively from an increased renal clearance of uric acid. Colchicine had no demonstrable effect upon the quantities measured. It has proved feasible to divide miscible uric acid into three compartments: (1) in solution in plasma water, (2) in solution in nonplasma body water, and (3) in the solid phase. It is predominantly the uric acid in the last of these compartments that is subject to wide excursions in response to therapy. (auth)

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6059 Effect of Thiouracil on Uptake of Radioactive Iodine by Thyroid Gland of Summer Frogs (Rana Pipiens). Samuel A. Matthews. Am. J. Physiol. 162, 590-7 (1950) Sept.

The thyroid gland of summer frogs (Rana pipiens) takes up about 3% of an injected tracer dose of I^{131} in 24 hr. The amount continues to increase up to 48 hr after injection, when between 4 and 5% of the injected iodine is present in the gland. Autographs show that this material enters the colloid and becomes organically bound there within 1 hr after injection. The thyroid of animals treated daily with 5 mg of thiouracil for 5 days or more takes up only one-fifth as much iodine from an injected dose as does the thyroid of control animals. Some of this is also organically bound and appears in autographs of the gland. (auth)

6060 Evidence for Conversion of Carbon Monoxide to Carbon Dioxide by the Intact Animal. Robert T. Clark, Jr. Am. J. Physiol. 162, 560-4(1950) Sept. (See also NSA 4-1355.)

The rate of oxidation of CO to CO_2 by turtles and mice exposed to low CO concentrations has been measured by gasometric methods and by a radioisotope technique using C^{14}-labeled CO. The CO consumed is proved to be oxidized to CO_2, and the rate of oxidation in mice is found to be 10 times as great as would be expected from previous experiments on isolated tissue exposed to high CO concentrations.

6061 Extrahepatic Lipid Synthesis. G. Popják and Marie-Louise Beeckmans. Biochem. J. 47, 233-8(1950) Aug.

Cholesterol and fatty acid synthesis has been studied in rabbits with the aid of deuterium- and C^{14}-labeled acetate. It has been demonstrated that cholesterol is synthesized not only in the liver, but also in the intestine and ovaries. The probable source of plasma cholesterol is the liver. Synthesis of fatty acids has been shown to occur along the entire gastrointestinal tract and in the lung. The utilization of acetate for fatty acid synthesis is especially high in the latter organ. In the intestine and lung the phospholipin fatty acids contained more isotope (deuterium or C^{14}) than the glyceride fatty acids, whereas in the liver the two types of fatty acids appear to come rapidly into equilibrium. The possible significance of these findings is discussed. (auth)

6062 Fluid Volumes and Electrolyte Concentrations in Normal Rabbits. Jerry K. Aikawa. Am. J. Physiol. 162, 695-702(1950) Sept.

The normal values and their random variations for the extracellular fluid compartments in normal rabbits have been determined. Plasma volume was determined by the T-1824 dye method, the thiocyanate space by the dilution of sodium thiocyanate, and the radiosodium space by the dilution of Na^{24}. Serum sodium and potassium concentrations were measured by flame spectrophotometry.

6063 Formation of Formaldehyde and Formate in the Bioxidation of the Methyl Group. Cosmo G. Mackenzie. J. Biol. Chem. 186, 351-68(1950) Sept.

Radiosarcosine, C^{14}-labeled, has been prepared and incubated with rat liver homogenates and surviving liver slices. The subsequent isolation of $HC^{14}HO$ indicates that formaldehyde is a naturally occurring compound in the animal organism. $HC^{14}OOH$ and $C^{14}O_2$ are also produced in the oxidation of the radiosarcosine and, together with $HC^{14}HO$, are excreted following intraperitoneal administration of radiosarcosine to the intact animal. Radiobetaine has been administered to a rat with formaturia, causing $HC^{14}OOH$ to be excreted. The significance of these results with respect to the role of single-carbon compounds in biosynthetic reactions is discussed.

BIOLOGY AND MEDICINE

6064 A Fundamental Consideration of Anticoagulant Therapy. L. B. Jaques. New England J. Med. 243, 395-401(1950) Sept. 14.

The purpose of anticoagulant therapy is to maintain a condition of reduced coagulability of the blood in order to reduce the danger of thrombosis. Since reduced coagulability introduces the danger of hemorrhage, it is essential to control the degree of hypocoagulability. With heparin, maintenance of hypocoagulability depends on adequate blood levels of the anticoagulant, whereas with Dicumarol it depends on adequate levels in the liver. Control over these levels can be obtained by determinations of the coagulability of the blood itself, i.e., determinations of the clotting time for heparin and of the prothrombin time for Dicumarol. Methods for making these determinations are given, and recent evidence for the action of Dicumarol obtained by using the C^{14}-labeled compound is discussed. 37 references.

6065 Incorporation in Vitro of Labeled Amino Acids into Bone Marrow Cell Proteins. Henry Borsook, Clara L. Deasy, A. J. Haagen-Smit, Geoffrey Keighley, and Peter H. Lowy. J. Biol. Chem. 186, 297-307(1950) Sept.

Amino acid uptake by intact rabbit bone-marrow cells has been studied in vitro using glycine-1-C^{14}, l-leucine-1-C^{14}, l-lysine-1-C^{14}, l-lysine-6-C^{14}.

6066 Incorporation in Vitro of Labeled Amino Acids into Rat Diaphragm Proteins. Henry Borsook, Clara J. Deasy, A. J. Haagen-Smit, Geoffrey Keighley, and Peter H. Lowy. J. Biol. Chem. 186, 309-15(1950) Sept.

The uptake of glycine-1-C^{14}, l-leucine-1-C^{14}, and l-lysine-1-C^{14} by an intact adult tissue having predominantly one type of cell has been studied in vitro, using rat diaphragm.

6067 Incorporation in Vivo of ^{15}N-Labeled Glycine into Liver Fractions of Newly Hatched Chicks. Tore Hultin. Exptl. Cell Research 1, 376-81(1950) Aug.

In the livers of newly hatched chicks, N^{15} from labeled glycine is incorporated in vivo into the microsome proteins earlier and at a more rapid rate than into the proteins of any other cell fraction isolated by differential centrifugation. The microsomes, moreover, probably contribute in a high degree to the surprisingly high isotope level of the considerable amounts of cell fluid proteins. Since the microsomes are especially rich in ribonucleic acid, and the production of phosphate-bound energy is centered in the mitochondria, the experiments indicate that the immediate availability of ribonucleic acid is more important for the formation of proteins than a close proximity to energy-producing enzyme systems. (auth)

6068 Intermediates in Photosynthesis. E. W. Fager, J. L. Rosenberg, and H. Gaffron. Federation Proc. 9, 535-42(1950) June.

BIOLOGY AND MEDICINE

Phosphoglyceric acid, C^{14}-labeled, has been isolated from the hot water extract of photosynthesizing algae by successive adsorptions on and fractional elutions from anion exchange resins and has been shown to be an important intermediate in photosynthesis. By following the time course of tracer fixation in phosphoglyceric acid and pyruvic acid and the photochemical reduction of phosphoglyceric acid, the authors find evidence for the presence of a labile precursor to phosphoglyceric acid, a compound formed by the addition of CO_2 to a two-carbon acceptor which in turn is made from phosphoglyceric acid in a cyclic process. A schematic diagram of a cycle satisfying the known facts of photosynthesis is given, and its relation to other metabolic processes is discussed. 11 references.

6069 The Intracellular Distribution in Rabbit Liver of Injected Antigens Labeled with I^{131}. Charles F. Crampton and Felix Haurowitz. Science 112, 300-2 (1950) Sept. 15.

In order to investigate the intracellular distribution of antigens, rabbits were injected intravenously with I^{131}-radioiodinated ovalbumin or beef serum, and, after 75-min to 48-hr intervals, the morphological fractions of the liver were separated by centrifugation. The bulk of the deposited antigen is found in the mitochondria, indicating that these particles are involved in the formation of antibodies.

6070 Measurement of Capillary Exchanges with the Aid of Radioactive Indicators. F. F. Morel. Helv. Physiol. et Pharmacol. Acta 8, 146-68(1950) July (in French).

By introducing into blood circulation the radioactive isotope of an extracellular element and by measuring the variations of the concentration of the tracer in the blood plasma, it is possible to determine the rate of transcapillary exchanges of this element, as well as the volumes of the intravascular and extracellular compartments. Two different techniques in the rabbit, involving the use of Na^{24}, gave comparable results. The concept of "sodium space" is criticized. Under the assumption that, as far as ionic capillary exchanges are concerned, diffusion processes play a secondary part while the ultrafiltration plays the main role, the data obtained with radiosodium make it possible to estimate the filtration rate through the capillary wall at 15% of the blood flow. (auth)

6071 The Metabolism of Glycine by Folic Acid-Deficient Chick Liver Homogenates. John R. Totter, Barbara Kelley, Paul L. Day, and Raymond R. Edwards. J. Biol. Chem. 186, 145-51(1950) Sept.

Liver homogenates from folic acid–deficient and –replete chicks have been incubated with C^{14}-carboxyl-labeled glycine, and the incorporation of the radioactive carbon into the proteins and phospholipides has been measured. Proteins and phospholipides of the livers from deficient chicks are found to be only one-half to one-third as active as those from the folic acid–fed chicks. Carrier isolations, conducted on the supernatants after precipitation of the proteins, have supplied evidence on the role of folic acid in the biosynthesis of purines and pyrimidines.

6072 The Metabolism of Silver in the Rat with Radiosilver Used as an Indicator. Kenneth G. Scott and Joseph G. Hamilton. Univ. Calif. Pubs. Pharmacol. 2, 241-62 (1950).

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The preparation of carrier-free radiosilver from Pd and the biological methods used to study silver metabolism are described. The findings on the way in which rats handle small amounts of silver differ from the findings reported on argyria. After the administration of about 10^{13} atoms of silver, excretion is immediately and thoroughly accomplished, principally by the liver. Silver administered intragastrically was not absorbed within the limits of sensitivity of the method. The distribution of silver in the rat after intravenous injection is the same as that observed after intramuscular injection. When the dose of silver atoms per rat was increased from 10^{13} to 10^{18}, a concentration commonly used in therapy, a 10- to 100-fold increase in the concentration of silver was observed in such organs as liver, kidney, spleen, skin, bone, and muscle. The effect of liver damage and bile-duct litigation and the blood chemistry of tracer concentrations of silver are discussed.

6073 The Nucleus-Dependence of P^{32} Uptake by the Cell. Daniel Mazia and Henry I. Hirshfield. Science 112, 297-9(1950) Sept. 15.

Nucleate and enucleate halves of Amoeba proteus cells have been cultured on a medium containing $P^{32}O_4$ to investigate the role of the nucleus in basal processes involving phosphorus uptake. It is concluded that metabolic mechanisms in the cytoplasm which can be measured by P^{32} uptake are nucleus-dependent and that the nucleus itself does not turn over a significant proportion of the phosphorus. The question of the mechanism of the nucleus-dependence is discussed.

6074 On the Metabolism of β-Alanine. Jack Graff and Henry D. Hoberman. J. Biol. Chem. 186, 369-72 (1950) Sept.

β-Alanine, labeled with N^{15}, has been injected into fasting rats for the purpose of measuring its retention. It is found that the amino acid is extensively degraded. From measurements of the rate of excretion of urinary N^{15}, estimates are made of the rate of incorporation of the nitrogen of β-alanine into urea and into peptide bonds. The results of these calculations indicate that β-alanine is more rapidly deaminated than either l-aspartic acid or glycine, whereas the rate of incorporation of nitrogen into peptide bonds is the same for the three amino acids. (auth)

6075 Plasma and Red Cell Iron Turnover in Normal Subjects and in Patients Having Various Hematopoietic Disorders. R. L. Huff, T. G. Hennessy, R. E. Austin, J. F. Garcia, B. M. Roberts, and J. H. Lawrence. J. Clin. Invest. 29, 1041-52(1950) Aug.

Iron tagged with Fe^{59} and injected intravenously has been used to determine the plasma and red-cell iron turnover rate in normal humans and in patients with hematopoietic diseases. Plasma iron turnover in normal men is approximately 1.5 times the amount required for the renewal of red-cell iron. Plasma iron turnover is increased in the polycythemias, in the leukemias, in pernicious anemia, and in hemolytic anemia. Radioisotope therapy reduces the excessive plasma iron turnover rates in polycythemia vera. Iron turnover data are useful in the management of this disease. In some cases of refractory anemia the plasma iron turnover rate is reduced; in others it is increased. The excessive plasma iron turnover rate of a pernicious anemia patient in relapse returned to near normal with therapy. The turnover rate of plasma

iron is a much more sensitive indicator of abnormalities of iron metabolism than is a plasma iron determination alone. 30 references. (auth)

6076 Proteolytic Activity Determined with a Substrate Tagged with Radioactive Iodine. N. Raphael Shulman and Henry J. Tagnon. J. Biol. Chem. 186, 69-75 (1950) Sept.

Fibrinogen has been tagged with radioactive I^{131} by a simple method. A fibrin clot formed from the tagged fibrinogen is found to constitute an adequate substrate for certain proteolytic enzymes within the pH range 6.3 to 8.8. The increase of radioactivity in the filtrate of this clot after incubation with enzyme is taken as a measure of proteolytic activity. In this way it is possible to measure accurately increments of proteolytic activity equivalent to 2.5×10^{-9} to 4.7×10^{-9} hemoglobin trypsin unit. The method is more sensitive and more accurate than methods used previously for the detection and measurement of small amounts of plasmin and trypsin and may be applicable to other similarly reacting proteolytic enzymes. (auth)

6077 The Relative Availability of Phosphorus in Various Phosphate Carriers as Determined by Use of Radioactive Materials. Matthias Stelly and H. D. Morris. Proc. Assoc. Southern Agr. Workers 47, 48(1950) Feb. 9-11.

A field experiment was conducted with cotton on Cecil sandy clay loam at Whitehall, Georgia, to obtain information on the relative availability of the phosphorus in superphosphate, calcium metaphosphate, ammoniated superphosphate (3% NH_3), dicalcium phosphate, and alphatricalcium phosphate, using P^{32}-tagged materials. The results of this experiment are briefly summarized in this report.

6078 Secretion of Radiocalcium in Milk, A. H. W. Aten, Jr., and C. B. Heyn. Am. J. Physiol. 162, 579-80 (1950) Sept.

A calcium chloride solution, tracer-labeled with Ca^{45}, was injected subcutaneously into a milch goat, and the subsequent activity in the milk and plasma was measured. The specific activity of the milk calcium increased steadily, reaching the level of the plasma calcium after about 4 hr. The plasma activity remained stationary during the first few hours and decreased at an appreciable rate after 5 hr.

6079 Studies on the Incorporation of Injected Cytochrome C into Tissue Cells. II. Injection of Radioactive Cytochrome C into Normal Rats. Helmut Beinert, Priscilla Matthews, and Everett O. Richey. J. Biol. Chem. 186, 167-76(1950) Sept. (See also NSA 4-374.)

Radioiron-labeled cytochrome with a radioactivity suitable for tracer work has been produced by biosynthesis in rats which were made anemic and then injected with radioiron during their period of rapid growth. This cytochrome was injected into rats, and the distribution of radioiron was established at various times after injection and exposure to hypoxia.

6080 Studies on Mitochondria: I. The Association of Cyclophorase with Mitochondria. John W. Harman. Exptl. Cell Research 1, 382-93(1950) Aug.

Among other experiments indicating that mitochondria are the morphologic units of the cyclophorase system and that a close correlation exists between the state and number of

mitochondria and the extent of cyclophorase activity, the incorporation of inorganic P^{32} during oxidative phosphorylation is shown to be characteristic of the mitochondria but not of the "microsomes."

6081 Studies on Mitochondria: II. The Structure of Mitochondria in Relation to Enzymatic Activity. John W. Harman. Exptl. Cell Research 1, 394-402(1950) Aug.

Mitochondria are visualized as composite structures, in part of which the integrated enzyme systems are concentrated. The behavior of mitochondria in deionized water and in salt solutions is compatible with a gel-like structure and does not require the presence of a semipermeable membrance. The accumulation of Na^{24} and K^{42} in cyclophorase suspensions was used to show that mitochondria neither exclude nor concentrate sodium and potassium ions.

6082 Sulfur Metabolism in Escherichia Coli. I. Sulfate Metabolism of Normal and Mutant Cells. Dean B. Cowie, Ellis T. Bolton, and Margot K. Sands. J. Bact. 60, 233-48(1950) Sept.

The application of biochemical mutants, radioactive tracer techniques using S^{35}, competitive utilization of metabolites, and chromatography have been used to study sulfate metabolism in Escherichia coli.

6083 A Tracer-Element Technique in the Study of Root Extension. W. L. Lott, D. P. Satchell, and N. S. Hall. Proc. Am. Soc. Hort. Sci. 55, 27-34(1950) June.

Because of the difficulty of determining the location and number of roots of vines or trees by digging away the soil and of determining visually which roots are active in the absorption of water and minerals, the use of tracer elements to solve this problem has been tested. Superphosphate containing radiophosphorus, P^{32}, was placed in auger holes at various distances from the base of vines in a muscadine grape vineyard, and the P^{32} uptake by leaves or terminal growth was determined at a later date. The movement of phosphate in the soil was also investigated. The application of the results to such problems as the placement of fertilizer for most efficient utilization and the number of guard rows to include in experimental plots is discussed.

6084 Transcapillary Exchange Rate and Volume of Distribution of Sulfate and Sodium as Indicated by $S^{35}O_4$ and Na^{24} in the Rat. Guy C. Sheatz and Walter S. Wilde. Am. J. Physiol. 162, 687-94(1950) Sept.

Intravenously injected sulfate tagged with S^{35} undergoes an instantaneous reversible equilibration into blood corpuscles of rats. This demonstrated equilibrium permits the derivation of a turnover rate for sulfate from a common blood pool by fitting an exponential equation to the plasma tracer disappearance curve. An appropriate factor then re-expresses this rate as a fraction of plasma sulfate. It is estimated that 0.14 of the plasma sulfate traverses the capillaries each minute. We find an identical value for Na^{24}, which, considering the great difference in the mobility of these two ions, fails to exhibit the difference in rate reasonably expected to result from a diffusion mechanism. At equilibrium this sulfate is distributed through 34% of the rat body. This exceeds our sodium space of 25.4%. The occurrence of tracer sulfate in liver, corpuscles, etc., does not account for its large volume of distribution. (auth)

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6085 The Transfer of Radioactive Mercury across a Membrane Produced by the Application of Cantharides to the Skin of Man. Frank J. Kelly, Arthur H. Svedberg, and Vernon C. Harp, Jr. J. Clin. Invest. 29, 988-97(1950) Aug.

The cantharides blister provides a suitable model for the study of membrane permeability in living human subjects. Studies with the use of radioactive $Hg^{203,205}$ incorporated in a mercurial diuretic were carried out with this technique. Mercury was found to traverse the membrane at the base of the blister in both directions in a predictable manner. No significant differences in transfer of mercury across the membrane were noted in patients with congestive heart failure and in control subjects. Results offer suggestive evidence of physiologically effective binding of mercury to plasma proteins. (auth)

6086 The Use of a Radioactive Isotope in Determining the Retention and Initial Distribution of Airborne Bacteria in the Mouse. L. J. Goldberg and W. R. Leif. Science 112, 299-300(1950) Sept. 15.

Suspensions of radiophosphorus-tagged bacteria, produced by incubating an avirulent strain of Pasteurella pestis in a medium containing P^{32} as soluble phosphate, were atomized, and mice were exposed to the resulting aerosol. Approximately 30% of the airborne material retained in the mouse is found in the respiratory tree, as compared with 70% in the gastrointestinal tract.

6087 Use of Spores Labeled with Radiphosphorus in the Study of the Respiratory Retention of Aerosols. F. E. Buckland, G. J. Harper, and J. D. Morton. Nature 166, 354-5(1950) Aug. 26 (Letter to the editor).

B. subtilis was grown on CCY agar (less glycerophosphate) containing P^{32} as disodium hydrogen phosphate up to 650 mc/liter. Spores were reaped after 45 hr, heated at 60°C for 1½ hr, and washed at least 6 times to remove soluble P^{32} salt. Guinea pigs were exposed to aerosols of single organisms in apparatus used with a Collison spray and to aerosols of larger particle size generated from a spinning disk. The guinea pigs were sacrificed, and their tissues were assessed for spores by a Geiger counter.

6088 Utilization of Nitrogenous Compounds by Plants. B. P. Ghosh and R. H. Burris. Soil Sci. 70, 187-203(1950) Sept.

Clover, tobacco, and tomato plants have been grown aseptically to an age of 4 to 8 weeks on a variety of nitrogenous compounds. Chlorella pyrenoidosa also has been tested for its ability to use these substances. The growth response of these plants to amino acids, ammonia, and nitrate is reported. When ammonia labeled with N^{15} and a single amino acid were supplied together to tobacco and clover plants, all the cultures assimilated ammonia readily, but many of the amino acids also were used. Most of the amino acids that did not support good growth alone were not toxic, since plants supplied with these amino acids plus ammonia grew rather well. Analysis for the N^{15} content of clover and tobacco plants simultaneously furnished with $N^{15}H_4^+$ and single amino acids indicated that usually the plant initially uses its reserve of seed nitrogen, then uses ammonia, and finally uses the nitrogen from the amino acids. 21 references.

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6089 On the Stability of Certain Organic Complexes Containing Elements of the 4th and 5th Groups of the Periodic Chart. Part II. Oxalates, Citrates, and Tartrates of Cb, Ta, and Pa. M. Haissinsky and Yang Jeng-Tsong. Analyt. Chim. Acta 4, 328-31(1950) Aug. (in French).

The preparation of hydroxides and complexes of Nb, Ta, and Pa, their decomposition by alkalis, and the pH measurements were made according to methods previously used for Ti, Zr, and Th compounds and described in the first part of the work (Analyt. chim. Acta 3, 422(1949)). The resistance to hydrolysis of the complexes of Nb and Ta decreases in the order oxalate > citrate > tartrate; for the oxalates it is Nb > Ta, while it is Nb < Ta in the case of the citrates. The behavior of the complexes of Zr and Ta permits the prediction of that of the complexes of Pa. (auth)

6090 Physical Chemistry Research at the University of Leeds. George J. Szasz. Office of Naval Research London Technical Report ONRL-57-50, May 26, 1950. 7p.

Current research activities in physical chemistry at the University of Leeds are briefly described. They include molecular structure determinations by x-ray analysis, highly precise measurements of compressibilities of organic vapors, investigations of the shapes and configurations of high-molecular-weight compounds by studies of their evaporation and diffusion rates, studies on the mechanism and kinetics of hydrocarbon oxidation, and studies on the ionization potentials of simple molecules. (auth)

6091 Determination of Radon with the Aid of a Photomultiplier. A. Drigo. Nuovo cimento 7, 501-11 (1950) July 2 (in Italian).

Scintillation counters were used for the determination of radon contents in gases by measuring the activity of solid deposits of disintegration products of Rn. For Rn contents exceeding 10^{-11} c/cm³, that fraction of RaA atoms which is positively charged is deposited on a negative electrode (metal or Ca-Mg-containing glass) placed in a 10-liter gas container. In the case of lower contents, ranging mainly from 10^{-14} to 10^{-15} c/cm³, the deposit is collected with the aid of a corona discharge produced in a 50- to 100-liter closed container. In both cases the duration of the precipitation procedure is about 2 hr. The activity 0.6×10^{-18} c/cm³ corresponds to a content of 1 to 2 atoms of Rn per cubic centimeter of air at the surface of the earth. The instruments described present the advantage of avoiding strong gas currents, which may cause a notable precipitation on the noncharged parts of the instrument (Freed et al., J. Franklin Inst. 231, 345(1941)).

6092 A Radioactive Technique for Micro-Estimation of α-Amino-Acids and Its Application to Paper Partition Chromatograms. S. Blackburn and A. Robson. Chemistry & Industry 1950, 614(1950) Aug. 12 (Communication to the editor).

Microgram quantities of amino acids separated by paper chromatography may be estimated by reaction with a copper phosphate suspension to give complexes of the type $(H_2NCHRCOO)_2Cu$. The copper complex formerly has been

determined by polarography or colorimetry. A radiometric method of comparable accuracy has been developed by tagging the copper phosphate with 12.8-hr Cu^{64} and counting the resulting amino acid complex with an end-window G-M tube. The relation between amino nitrogen and copper activity was linear down to 1 mg of amino nitrogen.

6093 On Mendeleev's Periodic Table of Elements. E. S. Sarkisov. Zhur. Fiz. Khim. 24, 487-502(1950) April (in Russian).

In the author's opinion the large number of periodic tables of elements, presented by various writers in recent years, distort the natural classification given by Mendeleev. The author's universal equations for atomic radii R and atom distances d in crystals confirm quantitatively the rationality of Mendeleev's groups and subgroups. If C_1 and C_2 are constants, n the group number, and F a function of the atomic number, then $R = C_1(F/n)^{1/3}$ and $d = C_2(F/n)^{1/3}$. For all elements except the lanthanides (and possibly the actinides), $F = Z^{1/3}$. The deviations shown by the rare earths (interatomic contractions) are quantitatively explained by a corrected expression for F reflecting the gradual filling of the 4f shell; these considerations agree with the findings of Hevesy on molecular contractions in lanthanide sulfates (Z. anorg. u. allgem. Chem. 147, 217; and 150, 68(1925)) and with those of Goldschmidt (Ber. 60, 1282(1927)) and Bommer (Z. anorg. u. allgem. Chem. 241, 273(1939)) on similar phenomena in lanthanide oxides X_2O_3.

6094 Crystal Structure of Cesium Pentachloromonoaquothallate, $Cs_2TlCl_5H_2O$. Tokunosuké Watanabé and Masao Atoji. J. Am. Chem. Soc. 72, 3819-20(1950) Aug. (Note).

A detailed study of the atomic parameters using Patterson diagrams has been made, and the isomorphism of $Cs_2TlCl_5H_2O$, $(NH_4)_2FeCl_5H_2O$, and $(NH_4)_2InCl_5H_2O$ has been established. Interatomic distances are listed.

6095 The Preparation and Structure of Lanthanum Cobaltic Oxide. Fred Askham, I. Fankuchen, and Roland Ward. J. Am. Chem. Soc. 72, 3799-800 (1950) Aug. (Note).

$LaCoO_3$ has been prepared by heating in air mixtures of the hexahydrates of lanthanum and cobaltous nitrates. The x-ray diffraction pattern indicates a rhombohedral structure, $\alpha = 90°42'$, $a = 3.82 \pm 0.01$ A. The density of 7.2 g/cc corresponds to one formula weight per unit cell.

6096 The Capture of Hydrogen Atoms by Ammonia Molecules; A Complementary Study. W. Mund, P. Huyskens, and R. Lories. Bull. classe sci. Acad. roy. Belg. 35, 995-1007(1949) Dec. 3 (in French).

Ammonia in quantities of the order of 1% is known to be a negative catalyst for the reaction $H_2 + D_2 \rightarrow 2HD$. Although it has been concluded that the inhibition is caused by capture of H and D atoms by NH_3 molecules, the mechanism of this capture is unknown. Because of the importance of this process in the kinetic interpretation of many reactions, further experimental and theoretical studies have been carried out. The average apparent energy of activation of the $H + D_2 \rightarrow HD + D$ and $D + H_2 \rightarrow HD + H$ reactions is found to be about 3900 cal, a value nearer to the true activation energy than that previously obtained. The inhibition by NH_3 has been confirmed, and the diminution of the initial reaction velocity is found to be a direct function of the concentration of NH_3. At higher temperatures the degree of inhibition decreases, indicating that the H or D atoms are attached to the NH_3 molecules only by van der Waals forces. This hypothesis may also explain the failure of NH_3 in an α-irradiated NH_3-D_2 gaseous mixture to substitute appreciable amounts of deuterium for hydrogen.

6097 Vapor Pressure and Heat of Vaporization of Hexadecafluoroheptane and Chlorotrifluoroethylene. P-V-T Relationship of Chlorotrifluoroethylene. J. W. Grisard, C. W. Cunningham, and G. D. Oliver. K-654, Aug. 23, 1950. 13p.

The vapor pressure of hexadecafluoroheptane has been measured over the temperature range 0 to 106°C, and the following equation has been derived to fit the data: $\log_{10} P = 6.96493 - 1196.067/(t + 210.36)$, where P is in mm Hg and t is in °C. Its calculated heat of vaporization is 7543 cal/mole at the boiling point, 82.50 ± 0.05°C. Vapor-pressure data on chlorotrifluoroethylene have been measured over the temperature range −67 to −11°C and are represented by the equation $\log_{10} P = 6.90199 - 850.649/(t + 239.91)$. Bubble-point pressures taken from P-V-T measurements over the temperature range 25 to 105.8°C are represented by the equation $\log_{10}) P = 7.75412 - 1392.82/(t + 319.70)$. The heat of vaporization calculated at a boiling point of −28.37 ± 0.05°C is 4965 cal/mole. Pressure-volume-temperature relations of chlorotrifluoroethylene have been measured for various isotherms between 25°C and the critical point. The experimental critical constants for hexadecafluoroheptane are $T_c = 201.7$°C, $P_c = 16.0$ atm, $D_c = 0.584$ g/ml; and for chlorotrifluoroethylene they are $T_c = 105.8$°C, $P_c = 40.1$ atm, $D_c = 0.55$ g/ml. (auth)

6098 Corrosion Experiments with Gaseous Boron Trifluoride. F. Hudswell, J. S. Nairn, and K. L. Wilkinson. Atomic Energy Research Establishment AERE-CR-468, June 1950. 10p.

A number of constructional materials — metals, alloys, and miscellaneous compounds — which may be required to come into contact with boron trifluoride, were subjected to treatment with this gas under carefully controlled conditions. The materials were examined by bringing them into contact with the gas at an original fixed pressure of about 25 cm of mercury, and at temperatures up to 200°C. The extent of the reaction, if any, was shown by the alteration of the gas pressure over the sample. Many of the materials examined showed a high resistance to chemical attack by boron trifluoride. Great variation was shown by the miscellaneous group of compounds. (auth)

6099 The Isomerism of the Oximes. Part XL. The Hydrolysis of Acyl Halogenobenzaldoximes by Alkalis O. L. Brady and S. G. Jarrett. J. Chem. Soc. 1950, 1227-32 May.

The preparation and properties of m-fluorobenzaldehyde and the ortho, para, and meta α-fluorobenzaldoximes and β-fluorobenzaldoximes and their acetyl derivatives are described in the experimental section of this report.

6100 Studies of Trifluoroacetic Acid. Part II. Preparation and Properties of Some Trifluoroacetyl Esters. E. J. Bourne, C. E. M. Tatlow, and J. C. Tatlow. J. Chem. Soc. 1950, 1367-9 May. (See also NSA 4-1689.)

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The following esters of certain hydroxy and polyhydroxy compounds have been prepared under anhydrous conditions: p-nitrobenzyl trifluoroacetate, β-naphthyl trifluoroacetate, d-mannitol hexakistrifluoroacetate, dulcitol hexakistrifluoroacetate, 2,3-bistrifluoroacetyl-4,6-benzylidine α-methylglucoside, 2,3,4,6-tetrakistrifluoroacetyl α-methylglucoside, and 3,5,6-tristrifluoroacetyl-1,2-isopropylidene d-glucofuranose. Their properties are described; they are very susceptible to hydrolysis and to methanolysis.

6101 H. W. Laboratory Manual; 100 Area Section. HW-12862, July 1, 1950. 366p.

The manual contains safety rules and job hazard breakdowns, specifications for the preparation of standard laboratory solutions, and instructions in the use of laboratory apparatus.

6102 A New and Significant Contribution to Glass Science. Alexander Silverman. Chemist 27, 355-6(1950) Sept. (Communication).

A high-energy x-ray or gamma-ray absorbing glass containing wolfram phosphate and a slow-neutron absorbing glass containing cadmium borosilicates with fluorides are reported. No further details of composition are included.

6103 Pipetting Device for Use with Radioactive Solutions. R. Beul and J. Harkness. Nature 166, 403(1950) Sept. 2 (Letter to the editor).

An all-rubber device with glass-bead valves for the suction filling of pipets with noxious liquids is described. It should prove to be an efficient means of handling radioactive solutions. All operations can be performed with one hand.

6104 The Activity Coefficients of $LaCl_3$, $CaCl_2$, KCl, NaCl, and HCl in Dilute Aqueous Solutions. Theodore Shedlovsky. J. Am. Chem. Soc. 72, 3680-2(1950) Aug.

Activity coefficients for $LaCl_3$ in water at 25°C obtained from measurements on the emf of concentration cells with transference are in accord with the Debye-Hueckel theory. New values are presented for activity coefficients of HCl, NaCl, KCl, $CaCl_2$, and $LaCl_3$, based on revised fundamental constants. (auth)

6105 Solubility of Mixtures of Cerium and Lanthanum Oxides in Acids. George Brauer and Heinz Haag. Z. anorg. Chem. 261, 179-86(1950) Mar. (in German)

Crystal structure and solubility in HCl of mixtures of CeO_2 and La_2O_3, obtained by calcination of mixtures of oxalates, were investigated. The structure is that generally known for similar calcined mixtures; namely, systems consisting of 100 to 40 mol % CeO_2 and 0 to 60% $LaO_{1.5}$ form mixed crystals of the fluorite type. As to the solubility, it does not lie between the solubilities of the components, nor is there any hindering influence (up to a certain limit composition) of one component upon the other; it appears that a superposition of several effects results in a complicated picture, of which an interpretation is attempted. (auth)

6106 On the Computation of Adsorber Data. H. H. Günthard, M. Kohler, H. R. Pfister, H. Auerswald, and B. Messikommer. Helv. chim. acta 33, 1118-26(1950) June 15 (in German).

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By taking into account both the kinetics of a specific chemical reaction taking place in the adsorber and various transportation phenomena, linear differential equations are obtained which permit a computation of dimensions of adsorbing columns for certain simple boundary cases.

6107 On the Kinetics of Isotope-Exchange Reactions. L. Waldmann. Z. Naturforsch. 5a, 399-400(1950) July (Note, in German).

If a temperature gradient is established in a gas (e.g., methane) consisting of molecules that contain two isotopes of an element (e.g., H and D), a very complicated picture of concentration changes, diffusion currents, and exchange-equilibrium perturbations will follow. An equation is derived that reduces this real picture to the imaginary simple one of a binary system of monatomic gases; the exchange reactions are excluded, and the application of the usual thermal diffusion computation methods permits the determination of isotope enrichments.

6108 The Separation of Mixtures of Solutes by Distribution between Solvents. I. The Separation of the Components of a Fixed Quantity of a Mixture by a Continuous Countercurrent Extraction Process. John D. A. Johnson and Alan Talbot. J. Chem. Soc. 1950, 1068-88 Apr.

The manner in which a fixed quantity of a solute, introduced all at once, distributes itself throughout a series of mixing vessels through which two solvents pass continuously in counter current is investigated theoretically. It is shown that mixtures of solutes having different distribution coefficients should be separable into their components, to extents dependent on the number of vessels in the system and on the relative flow rates of the solvents. The best condition for the separation of two solutes, present in equal proportions in the central vessel of an extended system, exists when the ratio of the feed rates is the inverse of the geometric mean of the distribution coefficients. The theoretical conclusions have been investigated by reference to the behavior of oxalic and succinic acids toward butanol saturated with water and water saturated with butanol, in 2- and 19-vessel systems; the experimental results are in substantial agreement with the theoretical requirements. (auth)

6109 Interferometric Measurements of Wave-Lengths in the Spectrum of Mercury Isotope 198. John M. Blank. J. Optical Soc. Am. 40, 345-6(1950) June.

Six lines in the spectrum of Hg^{198}, in the range 5790 to 3650 A, have been measured with Fabry-Perot etalons. The wavelengths obtained were 5790.6627, 5769.5984, 5640.7531, 4358.3376, 4046.5716, and 3650.1569 A. These results are compared with those previously reported. (auth)

6110 Isotope Shift in the Resonance Line 3261 A of CdI. P. Brix and A. Steudel. Z. Physik 128, 260-8(1950) July (in German).

A Fabry-Perot interferometer revealed an isotope shift in the line 3261 A of CdI, produced by a successive absorption in six atom beams from a common furnace, amounting to 0(Cd114); +13.5(Cd112); and +29.5(Cd110); all times 10^{-3} cm^{-1}. As in the case of CdII (Schueler et al, Z. Physik 82, 685(1933)), this shift is a nuclear volume effect. The odd isotopes showed a shift in the line 4800 A, with a center of

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gravity displaced with respect to that of the even-isotope shift by $(8 \pm 3) \times 10^{-3}$ cm^{-1} toward the violet.

6111 Chemical Syntheses of Radioisotope-labeled Compounds. I. Charles E. Crompton and Nathan H. Woodruff. Nucleonics 7, No. 3, 49-64(1950) Sept.

A bibliography and brief description of the synthesis of compounds labeled with C^{14}, I^{131}, S^{35}, and P^{32} are presented. The compounds are divided into 3 groups: (1) low carbon intermediate (C_1-C_4); (2) acyclic acids and derivatives; (3) amino acids.

6112 Esters Containing Phosphorus. Part X. Radioactive Diisopropyl Fluorophosphonate. B. C. Saunders and T. S. Worthy. J. Chem. Soc. 1950, 1320-2 May.

The remarkable physiological properties of diisopropyl fluorophosphonate include its miotic action, clinical applications in connection with glaucoma and paralytic ileus, and powerful anticholinesterase activity. In order to be able to investigate its mode of action with esterases, the P^{32}-tagged compound has been prepared. A description is given of a specially designed apparatus which enables an over-all yield of 62% to be obtained.

6113 The Preparation of Radioactive Morphine and Related Alkaloids by Biosynthesis. B. J. McIntosh, F. E. Kelsey, and E. M. K. Geiling. J. Am. Pharm. Assoc. Sci. Ed. 39, 512-15(1950) Sept.

The poppy, Papaver somniferum, has been grown in a sealed atmosphere containing $C^{14}O_2$ under daylight-type lamps giving a light intensity of about 200 foot-candles. An exposure of 21 days is sufficient for the incorporation of C^{14} into the morphine molecule in sufficient quantities for metabolic studies. The radioactive morphine is separated from the other alkaloids by adsorption on Permutit from a 50% alcohol solution. A substance with an ionization constant greater than 7.4×10^{-7} will act as an efficient eluant.

6114 Electron Exchange Between Manganate and Permanganate Ions by Solvent Extraction. Howard C. Hornig, George L. Zimmerman, and W. F. Libby. J. Am. Chem. Soc. 72, 3808-9(1950) Aug. (Note).

The electron exchange reaction between manganate and permanganate ions in basic solution has been re-examined by using pyridine extraction to separate the permanganate from the reaction solution and using Mn^{56} tracer to follow the exchange. The exchange is found to be too rapid to measure; even at 0°C exchange is complete in 35 sec. Since there is negligible exchange of oxygen between water and permanganate ion, this result constitutes strong evidence for the existence of rapid electron exchange between the two ions, probably involving 3d orbitals in the manganese atoms.

6115 Heterogeneous Catalysis, Liverpool, England, April 12 - 14, 1950. George J. Szasz. Office of Naval Research London Technical Report. ONRL-53-50, May 16, 1950. 22p.

Some of the papers and discussions presented at a meeting of the Faraday Society in Liverpool, April 12-14, 1950, on theories of adsorption and the properties of surface layers, adsorption and catalysis on metals and oxides, and techniques of measurement are briefly reported. The investigations reported include the use of deuterium to study the hydrogenation of ethylene and the use of O^{18} in the study of oxygen exchange on oxide catalyst.

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6116 The Emission Spectrum of Curium. John G. Conway, Milton F. Moore, and W. W. T. Crane, AECD-2917, July 22, 1950. Decl. Aug. 22, 1950. 16p.

The wavelengths of the most prominent lines in the arc and spark spectra of curium have been measured. The region covered extended from 2516 to 5000 A. The wavelengths of the lines are given, with a discussion of methods of spectrographic analysis of curium samples. (auth)

6117 Heat and Free Energy of the Reaction: $AmCl_3(c) + H_2O(g) = AmOCl(c) + 2HCl(g)$. A. Broido and B. B. Cunningham. AECD-2918, July 14, 1950. Decl. Aug. 22, 1950. 18p.

Equilibrium constants at various temperatures in the range 400 to 575°C have been determined for the vapor phase hydrolysis of americium trichloride. The reaction was studied by a flow method in which mixtures of HCl and H_2O gases were passed over the solid material mounted on a cantilever-type quartz fiber microbalance. The progress of the reaction could be determined by observing the weight change in the solid. From the data obtained and an estimate of the ΔCp of the hydrolysis reaction, values were calculated for the heats and entropies of the reaction. The entropy change in the hydrolysis reaction was calculated to be $\Delta S_{298°} = 36.7$ cal/deg/mole. The heat of reaction obtained was $\Delta H_{298°} = 23.9$ kcal/mole. The heat of formation of AmOCl(c) is calculated to be -251.3 ± 2.7 kcal/mole at 298°K. (auth)

6118 The Magnetic Susceptibilities of Some Compounds of Americium and Curium. W. W. T. Crane, J. C. Wallmann, and B. B. Cunningham. UCRL-846, Aug. 1, 1950. 10p.

The molar magnetic susceptibility of CmF_3 has been found to be $-22{,}500 \pm 4000$ cgs units in an environment at 295°K and $-58{,}000 \pm 6000$ in an environment at 77°K. The temperatures of the samples were probably significantly higher because of the self-heating caused by radioactivity of the isotope Cm^{242}. The susceptibility of CmF_3 is in agreement within experimental error of that expected theoretically for a $5f^7$ configuration. The susceptibility of AmF_3, corrected for diamagnetic contributions, was found to be 1040 ± 300, 1290 ± 300, and 1740 ± 300 at temperatures of 295, 199, and 77°K, respectively. The susceptibility of AmF_3, and its temperature dependence, is in agreement with a $5f^6$ configuration for Am^{+3} and a multiplet splitting between the $^7F_0$ and $^7F_1$ states comparable to kT, but smaller than in the case of europium (III). (auth)

6119 A Magnetic Susceptibility Study of the U-O System. J. K. Dawson and M. W. Lister. Atomic Energy Research Establishment. AERE-C/R-447, Feb. 1950. 30p.

A balance is described by means of which magnetic susceptibility may be measured on milligram amounts of solids by a modification of the Faraday method. With a maximum field strength as low as 2500 gauss, the susceptibility of a 10-mg sample of specific susceptibility 1×10^{-6} is measurable to ±0.5%. Apart from its obvious applicability to investigations on compounds of the elements beyond uranium, the method is advantageous even in systems which are more readily available. It has provided an additional line of approach to the system of nonstoichiometric uranium oxides and in the present investigation the magnetic susceptibilities

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of UO_3 and intermediate oxides up to U_3O_8 have been measured over the approximate temperature range 90 to 570°K. Oxides between UO_3 and $UO_{2.3}$ follow the Curie-Weiss law with relatively high values of Δ and the susceptibilities are consistent with the view that these oxides contain quadri- and sexivalent, but not quinquevalent, uranium. The susceptibility-temperature relationship of U_3O_8 appears to have the form $(\chi - k)(T + \Delta) = C$. It has a magnetic moment much below that predicted for $UO_2.2UO_3$ and agrees more nearly with that to be expected from $U_2O_5.UO_3$. The magnetic moment of UO_2 has a value corresponding to a $5f^2$ (or possibly $5f^16d^1$) rather than a $6d^2$ electron configuration for the U(IV) ion. UO, however, from measurements on UO/UO_2 mixtures appears to have its unpaired electrons in 6d orbits, although it is possible that deductions of this nature are not valid in such a "magnetically concentrated" compound. (auth)

6120 On Complex-like Organic Uranyl Compounds. Arno Mueller. Z. anorg. Chem. 261, 210-12(1950) Mar. (in German).

Continuing a study on complex-like organic uranyl compounds (J. prakt. Chem. 157, 89(1940)), three new products were prepared, viz, uranyl 2-ketodiacelonegluconate, uranyl 2-ketodiacetonegluconate, and uranyl diethylcitrate. The corresponding acids were treated first with $NaHCO_3$ (or $BaCO_3$), then with $UO_2SO_4.3H_2O$. The first two products did not crystallize from the viscous liquid obtained, while the third one crystallized readily. As has been expected from previous experience, the first named compound is more intensely colored and is more resistant to the action of light than the second one. The third product is easily decomposed by sunlight; a characteristic trait is its insolubility in alcohol.

6121 Preparation of Thin Films of Uranium Oxides for Radioactivity Measurements. E. Zimmer. Nuovo cimento 7, 520-3(1950) July 2 (in Italian).

The author obtains thin (less than 0.2 mg/cm²) films of uranium oxides (predominantly UO_2) by electrolytic deposition on stainless steel discs from a dilute water solution of uranyl nitrate and ammonium nitrate at 65°C. The horizontally placed cathode disc rotates in the upper part of the solution, a platinum wire forming the anode, the current density being about 0.7 amp/dm² and the duration of the electrolysis about 10 min. It has been found that, under these conditions, the quantity of precipitated matter is proportional to the quantity of uranyl nitrate originally employed, and that owing to the growing acidity of the solution, the thickness of the deposit cannot exceed 0.2 mg/cm².

6122 The Reduction of Uranium Hexafluoride with Hydrogen. J. K. Dawson, D. W. Ingram, and L. L. Bircumshaw. J. Chem. Soc. 1950, 1421-2 May (Note).

The calculated equilibrium constant of the reaction $UF_6(g) + H_2 = UF_4(s) + 2HF$ is 10^{58} at 25°C, which indicates that the reduction should go to practical completion. The authors have been unable to confirm this experimentally. The method used was to condense, at liquid-air temperature, a small quantity of UF_6 in a weighed pyrex tube of known volume. The tube was then filled with pure H_2 (dried over P_2O_5), sealed, weighed, placed in a furnace at a known temperature for 0.5 to 3 hr, and then broken in water containing a known excess of standard $K_2Cr_2O_7$ solution. A back titration with standard $(NH_4)_2Fe(SO_4)_2$ solution gave the weight of UF_4 formed. The percentage reduction ranged from 3.8% at 226°C to 59.1% at 331°C for a reaction time of 0.5 hr. Investigation of the effect of time showed that equilibrium was reached in 0.5 to 1 hr. Experiments also were made to investigate the kinetics of the reaction. Evidence was obtained for a homogeneous reaction in the gaseous phase, of first order with respect to each reactant, and also a heterogeneous reaction on the wall of the containing vessel. The results, however, were not conclusive.

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6123 The Relative Thermal Conductivities of Liquid Lithium, Sodium, and Eutectic NaK, and the Specific Heat of Liquid Lithium. F. L. Yaggee and Samuel Untermyer. ANL-4458, Apr. 21, 1950. 27p.

Determinations of the relative thermal conductivities of liquid lithium, sodium, and eutectic NaK under similar conditions show that lithium is not as efficient a heat-transfer medium as sodium, and is more efficient than eutectic NaK. Determinations were made in a simple conductivity apparatus. For a mean liquid temperature of 190°C to 200°C the value obtained for the thermal conductivity of sodium is in fair agreement with published values. The relative conductivities of lithium and NaK are roughly ½ and ¼ that of sodium at ~250°C. The values for the specific heat of liquid lithium show an increase in the specific heat of liquid lithium with an increase in temperature, although the numerical values are of the same order of magnitude as those reported from other sources. These specific heat values were calculated from a comparison of the cooling rates in air of aluminum-filled and lithium-filled stainless steel capsules. The numerical values reported for lithium are believed to have an accuracy of about ±10%.

6124 A Theory of the Envelope Type of Thermal Conductivity Tests. Arthur L. Loeb. NYO-595, May 22, 1950. 19p.

The well-known problem of the end effects in a cylinder of finite length has been circumvented by the use of spheroidal rather than cylindrical apparatus. After a general theory of heat flow is given, applications demonstrate the mathematical difficulties caused by discontinuities in the curvature of the surface of the heat conductor. The suitability of the spheroidal shape is demonstrated, and corresponding heat flow equations are derived, demonstrating the effects of the variable distance between any two isotherms on the amount of heat crossing any unit area of an isotherm. It is proved that the amount of heat flowing through a slice of a spheroidal isotherm made perpendicular to the axis of the spheroid is proportional to the width of the slice, and independent of the position of the slice with respect to the spheroid. This theorem is applied to find the heat distribution necessary to keep the core of the apparatus at uniform temperature. Because all measurements are made at thermal equilibrium, a rough estimate is given for the time necessary to reach equilibrium. (auth)

6125 Notes on the Use of Radon in Engineering Radiography. V. E. Pullin. Engineer 188, 452-3(1949) Oct. 21.

Radon is claimed to have an advantage over radium salts as a source of rays in industrial radiography because the smaller required volume permits sharper images at shorter focal distances and the high intensity permits reduced ex-

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posure time. Brief discussions are included on the availability of radon and on radiation protection, operating technique, films, and lead foil screens.

6126 Experiments with a Differential Pirani Gauge Leak Detector. A. H. Turnbull. Atomic Energy Research Establishment. AERE-G/R-477, Mar. 1950. 12p.

The principle of the differential leak detector is explained. With a differential Pirani gauge detector located on the backing side of a diffusion pump, where the average pressure was 15 μ Hg, the "noise level" of pressure fluctuations registered by the galvanometer in the detector control circuit was seven times less than that registered by a single Pirani gauge. The minimum air pressure change which could be detected by the differential arrangement was 10^{-5} mm Hg. With the optimum leak hunting conditions employed here, this corresponds to a leak of the high vacuum side of about 10^{-3} lusec. (auth)

MINERALOGY, METALLURGY AND CERAMICS

6127 Behavior of Refractor Oxides and Metals, Alone and in Combination, in Vacuo at High Temperatures. P. D. Johnson. J. Am. Ceram. Soc. 33, 168-71 (1950) May.

Changes in bulk density, shrinkage, and weight are given for carbon and for dry-pressed specimens of beryllia, magnesia, zirconia, thoria, molybdenum, and wolfram when fired for 2, 4, and 8 min under vacuum conditions, using 100°C increments in the temperature range 1500 to 2300°C. Temperatures at which instability of surface-to-surface contact was observed for the 21 possible binary systems of the foregoing substances are also described for identical conditions of testing. (auth)

6128 Measurement of the Torsion Properties of Alumina and Zirconia at Elevated Temperatures. J. A. Stavrolakis and F. H. Norton. J. Am. Ceram. Soc. 33, 263-8(1950) Sept. 1.

A precise instrument for measuring the torsion properties of refractories up to temperatures of 1500°C is described. The twist is measured by sapphire mirrors mounted on the specimen itself. The mechanical properties of dense alumina and dense stabilized zirconia were measured at various temperatures. Higher ultimate strengths were reached than those reported for other bodies. (auth)

6129 Geology and Radioactivity of the Medicinal Hot Mineral Baths of Arequipa. Alejandro Freyre. Minutes of Meetings and Proceedings of the Third Peruvian Congress of Chemistry, 737-54(1949) Oct. 17-23 (in Spanish).

The medicinal hot springs of Arequipa, Peru are known to contain small quantities of radon. The waters of the different springs and the adjacent rocks have been chemically analyzed and the radioactivity has been determined. Distribution of radioactivity in the minerals of the area, all of which contain on the order of 10^{-12}% radium, is shown to correspond to the radon concentrations of the springs, and an explanation of the distribution is discussed in terms of the geology and mineralogy of the region.

6130 The Application of Chemical Thermodynamics to the Study of Metallic Alloy Formation; Quarterly Progress Report for April 1, 1950 - July 1, 1950. R. S. Craig, W. E. Wallace, T. M. Buck, D. A. Edwards, E. E. Ketchen, C. B. Satterthwaite, and F. A. Trumbore. NYO-604, July 3, 1950. 9p.

Progress in the following studies is reported: experimental work involving the determination of heats of formation of sodium-potassium alloys and cadmium-magnesium alloys; free energies of formation of cadmium-magnesium alloys; and specific heat studies of the cadmium-magnesium system. For the latter, a description of the apparatus, method of calibration, preparation of the sample, and heat capacity measurements made on the alloy over the temperature range 11 to 300°K are reported. Calculations from published data of the ΔCp (cal/mol deg) of formation of the alloy are included.

6131 Beryllium Minerals and Considerations of Analytical Methods. Carlos do Prado Barbosa. Rev. quim. ind. (Rio de Janeiro) 19, 14-18(1950) Jan. (in Portuguese).

The history, occurrence, identification, production, and exportation of beryllium, as well as its analysis, properties, alloys, and oxides, are each briefly discussed.

6132 Densities of Liquid and Solid Indium. D. D. Williams and R. R. Miller. J. Am. Chem. Soc. 72, 3821(1950) Aug. (Note).

The densities of liquid and solid indium metal have been determined by a dilatometric method. The data give the following straight-line equations: d_{solid}(25 to 156.4°C) = 7.321 − 0.000713t, and d_{liq}(156.14 to 300°C) = 7.160 − 0.000813t, where t is the temperature in degrees centigrade. Over-all accuracy is within ±0.2%.

6133 Effect of Repeated Welding on the Physical and Metallurgical Properties of A-212 Plate. Part I and Part II. Project Baby. R. M. Hargrove, and M. H. MacKusick. Babcock and Wilcox Co. May 26, 1950. 38p. (AEC File No. NP-1700.)

Repeated welding and grooving was performed on A-212 firebox quality steel plate to determine the cumulative effect on the metallurgical and physical properties of the weld joint in the fusion and heat-affected zones. Four welds were successively made in the same weld groove. After each weld was finished, the plate was regrooved in the same location, as established by scribed guide lines, and rewelded. A transverse section was removed for examination from the starting end of each weld. Based on the results of microexamination and physical tests, it is concluded that after repeated welding in the same groove the base metal in the region exposed to the heat of welding is not detrimentally affected and retains the properties required of a steel for pressure vessel service. (auth)

6134 The Electrical Resistance of Liquid Gallium in the Neighbourhood of Its Melting Point. C. Dodd. Proc. Phys. Soc. 63B, 662-4(1950) Sept. 1.

In order to determine whether any discontinuous change in electrical properties takes place when a liquid is supercooled, measurements have been made on the resistance of liquid gallium. No such discontinuity has been found; the resistance varies linearly with temperature over the range investigated. The results yield values for the resistivity and temperature coefficient of resistance of liquid gallium. (auth)

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6135 On Electrolytic Precipitation of Metal Powders; Role Played by Mechanical Obstacles in the Close Vicinity of the Cathode. N. Ibl and G. Trümpler. Helv. Chim. Acta 33, 1370-8(1950) Aug. 1 (in German).

Electrolytic precipitation of Cu from $CuSO_4$ solutions was investigated in the presence of mechanical obstacles (chiefly $BaSO_4$ slimes) in the immediate neighborhood of the cathode. Powder precipitates were obtained with current densities about 1% of those usually required. This phenomenon is explained by a marked reduction in the number of Cu^{++} ions in the cathode film, which is due to the almost complete cessation of convection currents in the solution because of the presence of $BaSO_4$. (auth)

6136 A Preliminary Survey of Zirconium Alloys. C. T. Anderson, E. T. Hayes, A. H. Roberson, and W. J. Kroll. U. S. Bureau of Mines Report of Investigations 4658, Mar. 1950. 48p.

An investigation of zirconium alloys has been made with the object of determining the suitability of such alloys for high-temperature applications. This report covers the preliminary study of about 25 zirconium-rich alloy systems with respect to preparation, fabrication, tensile properties, metallographic structures, constitution, and heat resistance. The approximate limit of forgeability has been determined on the basis of the ability of a cast section to be swaged to rod at 850°C, the heat resistance has been studied by means of air exposure at 1200 and 1400°F, and the yield strength at room temperature and at 1200°F has been measured. Heat-treatment and metallographic studies of most of these alloys indicate that the equilibrium diagrams for the zirconium-rich alloys probably will resemble the $Fe\text{-}Fe_3C$ system. There is a limited solubility (5 to 10%) of the alloying elements in the cubic, or beta, form of zirconium and virtually no solubility in the hexagonal or normal form. The beta solid solution decomposes eutectoidally into alpha zirconium and an intermediate phase and therefore offers possibilities of varying the physical and mechanical properties by heat treatment. As the alloy additions are increased, the alloys become richer in an intermediate phase, which corresponds to ZrX_2 in most of the systems investigated. As in the case of most intermediate phase formations, the alloys become less workable as the amount of this phase increases.

6137 Temperature Variation of the Compressibility of Molten Sodium. T. E. Pochapsky and S. L. Quimby. Phys. Rev. 79, 892(1950) Sept. 1 (Letter to the editor).

A modification of the standard pulse method for the measurement of sound velocity permits the measurement of the temperature coefficient of this quantity for molten sodium with an accuracy better than 1%. Measurements made on singly and triply distilled sodium are indistinguishable. The velocity of sound at the melting point (97.6°C) is found to be 252,600 ± 500 cm/sec, and the temperature coefficient between this and 272°C, which is constant, to be -52.4 ± 0.3 cm/sec/deg. Values of the adiabatic compressibility of the material computed with these data and those of Rinck (Ann. Chim. Phys. 18, 395 (1932)) on the density of molten sodium are given.

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6138 Physics Research at the University Colleges of Wales. Gordon F. Hull, Jr. Office of Naval Research, London, Technical Report. ONRL-56-50, May 19, 1950. 7p.

The four University Colleges of Wales, constituting the University of Wales, are located at Aberystwyth, Bangor, Cardiff, and Swansea. Each university college has its own physics department, each of which is carrying on a research program. At Cardiff and Bangor x-ray analyses of organic crystals and of metals and alloys at various temperatures are being carried out. At Swansea the research is in the field of electrical discharges in gases and ionosphere radio research. At Aberystwyth the research is on high pressure transients and cosmic rays. The research activities are briefly described. (auth)

6139 Hydrogen Content and Energy-Productive Mechanism of White Dwarfs. T. D. Lee. Astrophys. J. 111, 625-40(1950) May.

The equilibrium states of white dwarf stars of arbitrary mass and chemical composition are discussed. An improved expression for electronic conductivity and free-electron density in the intermediate degenerate state is derived. It is found that no appreciable amount of hydrogen can exist in any white dwarf star. Investigations on stability show that a white dwarf star cannot live on the nuclear energy produced in its interior. The alternate mechanism of energy produced in the envelope is discussed. The equilibrium distribution of hydrogen in the envelope is also calculated. From this the observed fact of strong hydrogen lines in the spectrum of white dwarfs is explained. 21 references. (auth)

6140 An Interpretation of the Expansion of the Universe. E. Bagge. Z. Physik 128, 239-54(1950) (in German).

Hubble's expansion of the universe can be derived from a simple physical postulate. On the other hand, Fermi's theory of the origin of cosmic rays, when applied to the past stages of the expansion, leads to an exponential solution of the corresponding diffusion problem and, consequently, to the possibility of explosive phenomena. A relationship between the latter and the universe expansion is suggested. (auth)

6141 A New Approach to Cosmology. I. A. E. H. Bleksley. S. African J. Sci. 46, 343-6(1950) July.

There already exist a considerable number of cosmological theories, based on widely different hypotheses, but all give very similar results in the few points which are at present capable of experimental verification. This suggests that the existing theories must have certain elements in common, and that it might be possible to find a broad general theory which will give equally good agreement with observation without going into great mathematical or other detail. The present theory is based on certain broad axioms, in particular an axiom of operational definition (epistemological axiom). Certain consequences of these axioms are traced: (1) The age (T) of the universe is finite. (2) The radius (R) of the universe is finite. (3) The number of protons (N) in the universe is finite. (4) There exists a shortest meaningful distance in the universe, $\rho = \frac{1}{2}R/N$, which is identified with the diameter of the proton, $\rho = 2.8 \times 10^{-13}$ cm. (5) There exists a shortest meaningful period of time in the universe, $\tau = \rho/c = 0.9 \times 10^{-23}$ sec, i.e., time, like space, is quantized. It is suggested that a full mathematical investigation must be based on a non-Archimedean geometry and algebra, while dynamics must be based eventually on a calculus of finite differences. (auth)

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6142 A New Approach to Cosmology. II. A. E. H. Bleksley. S. African J. Sci. 47, 13-15(1950) Aug.

In this paper certain cosmological consequences of the uncertainty principle are traced, starting from the earlier assumption of a finite age T of the universe. (1) There exist a minimum significant energy $\epsilon = 10^{-43}$ ergs, and a minimum significant mass $\mu = 10^{-64}$ g. (2) The radius of the universe $R = cT = 2 \times 10^{9}$ light years. (3) The number of particles in the universe is 2.56×10^{79}, and the total mass of the universe 2×10^{55} g. The mean density of the universe is therefore 6×10^{-28} g/cm³. (4) The rate of recession v of the galaxies at distance r from the observer is found on certain assumptions to be given by $v/r = \frac{1}{3}T$, which does not agree very well with observations. The maximum rate of recession is thus one-third the velocity of light, a conclusion that it should soon be possible to test. (5) The mass of the proton is found to be 1.63×10^{-24} g. (6) The minimum mass of the meson is found to be about 70 electron masses. (7) The charges on the proton and the electron are not correctly evaluated by the present theory. (auth)

6143 The Absorption of Penetrating Cosmic Rays Underground. C. A. Randall, N. Sherman, and W. E. Hazen. Phys. Rev. 79, 905(1950) Sept. 1 (Letter to the editor).

At a depth of 850 mwe (8.5×10^{4} g/cm²) in a salt mine, the absorption in Pb of the penetrating component in cosmic rays was determined by means of coincidences between two trays of G-M counters separated vertically by 100 cm. The particles were absorbed in Pb about as would be expected after penetrating the given depth of earth, making it unlikely that any appreciable fraction of the penetrating particles was produced locally.

6144 A Contribution to the Study of Extensive Showers. Part I. E. Amaldi, C. Castagnoli, A. Gigli, and S. Sciuti. Nuovo cimento 7, 401-56(1950) July 2 (in Italian).

A comparison was made between the structure of extensive atmospheric showers as suggested by the experimental study of their electron component, and the picture taken from the cascade theory. Since mesons and nucleons are present in extensive showers, it was thought that a discrepancy must exist. The experimental setup consisted of 4 ionization chambers and 4 counter groups that registered multiplications of the shower's electron component in a lead filter (2.5 to 5 cm thick) surrounding the setup. The preliminary data obtained were compared with the results of a calculation based on an assumed spatial distribution of electrons and photons according to a modified Gaussian law. After taking into account the rather considerable experimental errors, the expected discrepancy, although not a large one, was found to exist. (auth)

6145 Delayed Particles in Extensive Air Showers. C. B. A. McCusker, D. M. Ritson, and T. E. Nevin. Nature 166, 400-1(1950) Sept. 2 (Letter to the editor).

An attempt has been made, using two different experimental arrangements, to detect delayed particles in extensive air showers. In the first experiment, performed under a thick concrete roof, the showers were selected by three trays of G-M counters placed at the apexes of a triangle of sides 5.3, 7.3, and 8.5 m. Pulses from a fourth tray of counters occurring 1.4 to 11.4 μsec later were recorded. In the second experiment, performed under a light roof, selection was by two trays horizontally separated by 2 m. Counts from a third tray, which was unshielded, or shielded by 20 cm of carbon or by 20 cm of lead, occurring 1.5 to 6.5 μsec later were recorded. No evidence was found for particles delayed by more than 1.5 μsec. It is unlikely that the fraction of delayed particles, if they occur, is greater than 5% in any case.

6146 Emission of Neutral Radiation in Cosmic-Ray Stars. E. Pickup and L. Voyvodic. Phys. Rev. 79, 899-900 (1950) Sept. 1 (Letter to the editor).

In a search for electron pairs associated with meson showers in photographic emulsions, one fairly definite case of an identified electron pair associated with a 43-pronged star has been obtained. Numerous electron pairs, not obviously associated with stars, with a fairly wide distribution in energy of approximately several hundred million electron volts have also been found. The electron energies are 65 ± 10 and 8 ± 2 Mev, giving 73 ± 12 Mev as the energy of the initiating ray. While the present event does not in itself give direct evidence for a neutral meson, the pair is compatible with its being produced by a lower energy photon of a coincident photon pair from a neutral meson decaying somewhere in the shower cone, and within a few microns of the star center, i.e., within a time $\lesssim 10^{-14}$ sec, if a fairly low energy neutral meson is assumed (E = a few mc^2). The density of neutral mesons is estimated.

6147 Extensive Air Showers and Total Cosmic Radiation. Phys. Rev. 79, 1006-7(1950) Sept. 15 (Letter to the editor).

Evidence is presented for the hypothesis that the "extensive air shower" is the source of all particles found in cosmic radiation at the lower altitudes. The case of electrons is treated in some detail and it is concluded that it is not unlikely that all electrons, which are not secondaries of μ mesons present in the cosmic radiation, are accounted for as belonging to extensive air showers.

6148 Heavy Nuclei in Primary Cosmic Radiation as Observed in Photographic Plates at Altitudes Reaching 29,000 M over Sea Level. M. M. Addario and S. Tamburino. Nuovo cimento 7, 389-400(1950) July 2 (in Italian).

Tracks of nuclei with atomic numbers >2 were observed in plates exposed at 29,000 m altitude. Using 35 of them, the following data were determined: atomic numbers (7 to 25), minimum energy of each nucleus in the stack of plates, its minimum energy when entering the atmosphere, angular distribution of the nuclei about the vertical, and the distribution of atomic numbers. It was concluded that the observed nucleons belong to the primary cosmic radiation. Two phenomena are discussed: the disintegration of a heavy nucleus in the glass of the plate, and its collision with a nucleus of the emulsion. (auth)

6149 The Intensity and Masses of Cosmic-Ray Particles. T. C. Merkle, Jr., E. L. Goldwasser, and Robert B. Brode. Phys. Rev. 79, 926-8(1950) Sept. 15.

Measurements have been made of the relative numbers of mesons and protons in the sea-level cosmic radiation. The measurements include those particles that have ranges in Pb between 4.0 and 13.0 cm. The masses were determined

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by observing the range and momentum of each particle. No evidence was found for any particles except positive protons (mass = 1893 ± 50 m_e) and positive and negative μ mesons (mass = 196 ± 3 m_e). The low value of the μ meson mass reported here may be due in part to the uncertainty of the range-energy relations in copper. As many protons as μ mesons were observed in the range interval from 4.0 to 13.0 cm Pb. The intensity of protons decreased with increasing range.

6150 Ionization Chamber Bursts at Very High Altitudes. G. W. McClure and M. A. Pomerantz. Phys. Rev. 79, 911-12(1950) Sept. 1 (Letter to the editor).

Ionization chambers were used to study the atmospheric absorption and the latitude dependence of the radiation which produces high energy nuclear disintegrations in the upper part of the atmosphere at geomagnetic latitude 52°N. The instruments were biased to respond to pulses $\geq$1.0 Po α. The counts recorded in these measurements result predominantly from two sources, nuclear evaporations occurring in the chamber walls, and heavy nuclei (charge $\geq$8) of the primary radiation. The curve representing the difference between the calculated heavy-nucleus counting rate and the measured total rate reaches a maximum at a depth of 36 mm Hg (49 g/cm²). The occurrence of such a maximum is a characteristic feature of a component of the cosmic radiation which becomes multiplied by a cascade process in penetrating the atmosphere. The fact that the peak occurs at a depth somewhat less than the geometrical mean free path for proton collisions (~70 g/cm²) is to be expected from the wide zenith-angle distribution of the primary rays.

6151 Lead Absorption of Cosmic Rays at Different Altitudes Near Magnetic Latitude 22° N. P. S. Gill. Nature 166, 318-9(1950) Aug. 19 (Letter to the editor).

Measurements were made on the absorption of cosmic rays in lead near magnetic latitude 22° N at altitudes varying from 600 to 16,800 ft in the Himalayas. Two similar telescopes consisting of three Geiger-Mueller tubes each with slabs of lead interposed, connected together in a coincidence circuit, were used, and thickness of lead above the telescopes was varied from 0 to 20 cm in steps of 4 cm. Up to a thickness of 12 cm of lead a rapid decrease is observed and from there on there is no appreciable decrease in intensity until the thickness of lead exceeds 25 cm. Beyond 25 cm of lead, the intensity shows a definite drop. This drop occurs at the same thickness of lead at all altitudes. The fact that the drop in the intensity curve at all elevations occurs at the same thickness of lead near magnetic latitude 22° N supports the suggestion of Swann and Morris (Phys. Rev. 72, 1262(1947)) that it is concerned with something happening in the lead and does not depend on the energy of the rays.

6152 Low Energy Electrons at the End of μ Meson Tracks. William F. Fry. Phys. Rev. 79, 893-4(1950) Sept. 1 (Letter to the editor).

Electron sensitive nuclear track plates (Eastman NTB-3), carried by meteorological balloons, were exposed to cosmic radiation in the stratosphere. A systematic search has been made for meson tracks which stopped in the emulsion. 158 mesons were found which fulfilled this requirement. Of these, 36 were σ mesons, 14 were π-μ decays, and 4 were π μ-e decays. The remaining 104 mesons showed no associated

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tracks other than electron tracks. The author discusses the low energy electrons originating at the end of some of these tracks.

6153 Nuclear Disintegrations Produced by the Nucleonic Radiation at 3500 M above Sea Level. J. Buschmann, I. F. Quercia, and B. Rispoli. Nuovo cimento 7, 457-69(1950) July 2 (in Italian).

The ratio N/P was determined between the frequencies of stars produced at 3500 m altitude by a neutral and by an ionizing component of cosmic rays. The instrument registered simultaneously the number S of pulses in a fast ionization chamber, and the number K of coincidences in the latter and a group of 28 Geiger counters surrounding the chamber. Apart from a small contribution from the extensive atmosphere showers, events S are nuclear disintegrations within the chamber, while K comprise stars generated both by an ionizing radiation (protons and π mesons) and by a neutral radiation (neutrons). By assuming that the probability of production of prongs of a given energy is the same for neutrons and protons, it can be written: $N/P = (1 - K/S)/(K/S - x)$, where x is the fraction of stars having at least one prong whose range exceeds 5.7 g/cm², (the latter value being the absorption taking place between the chamber and the counters). By this method, N/P was found to be 7 to 15 for stars of a total energy 6.5 Mev, and 2 to 8 for energies 8.1 to 10.8 Mev. Furthermore, it was established that the absorption range of the star-producing radiation in paraffin was 206 ± 40 g/cm². (auth)

6154 On Nuclear Evaporation in Cosmic Rays and the Absorption of the Nucleonic Component. II. G. Bernardini, G. Cortini, and A. Manfredini. Phys. Rev. 79, 952-63(1950) Sept. 15. (See also NSA 4-1472.)

The nuclear evaporations produced by cosmic rays at 3500 m altitude were studied using Ilford C2 and Kodak NT4 plates. The results are discussed in comparison with the results obtained in Berkeley for stars produced by nucleons of controlled energies and with some of the data furnished by the Bristol and Brussels groups. Some of the results are as follows. (1) The frequency of stars versus the number of prongs does not change very much in the transition between air and condensed materials. (2) The differences between the Berkeley and the cosmic-ray stars are concentrated in the large stars (more than six prongs), in agreement with the fact that a large fraction of cosmic-ray stars (about 80%) are produced by secondary nucleons having energies not exceeding some hundreds of million electron volts. (3) The prongs of the small stars (less than six prongs) produced by cosmic rays show an angular distribution around the vertical which is, at least qualitatively, that which must be expected from the Berkeley results. (4) The large stars show an isotropic distribution in the heavy prongs but not in the "grey" ones, and a correlation between the number of grey and the number of black prongs seems to be evident. On the average, every grey prong is accompanied by about 3.5 black prongs. (5) The energy spectrum of the black proton and alpha prongs is given with statistics based on about 4000 stars. The average excitation energy associated with every black prong is about 35 Mev; the average nuclear excitation corresponding to the black prongs emission is about 150 Mev.

6155 On the Origin of the Cosmic Radiation. C. Y. Fan. Phys. Rev. 79, 912-3(1950) Sept. 1 (Letter to the editor).

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Using Fermi's theory on the origin of cosmic radiation (Phys. Rev. 75, 1169(1949)) for the mechanism of acceleration of protons in interstellar spaces, and assuming that protons originate from a "point source" at some distance from the earth, the author applies the principle of random flight to calculate the energy spectrum of protons striking the earth from outer space. It is shown that results can be adjusted to fit the experimental results by choosing a suitable initial energy spectrum. The distance of the assumed source (center of our galaxy) from the earth is calculated to be 3.1×10^{22} cm. The implications that the protons originated from early type stars, or from explosions in the nucleus of our galaxy a long time ago over a long period, are discussed.

6156 On Penetrating Showers Generated in Lead and Carbon. L. Mezzetti and R. Querzoli. Nuovo cimento 7, 470-81(1950) July 2 (in Italian).

The rate of production of penetrating showers by ionizing agents was investigated in its dependence both on the atomic number of the material traversed by the primary, and on the total number of ionizing particles in the shower. The arrangement of Geiger counters employed was sensitive to showers of low penetrating power, and relatively small thicknesses of the two tested materials, lead and graphite, were used. It was found that the ratio of the collision mean free paths in lead and carbon is equal to 4.4 ± 1.0; that the distribution curve of the number of particles in showers agrees, in a general way, with that calculated by Heitler and Janossy (Proc. Phys. Soc. A62, 669(1949)); and that the evidence obtained could not throw any light on the respective merits of the "plural" and the "multiple" meson-production theories.

6157 The Origin of the Cosmic Radiation. Alfred Ehmert. Physik. Blätter 6, 206-17(1950)(in German).

Modern views on the origin of cosmic rays are summarized.

6158 The Solar Flare of November 19, 1949, and Cosmic Rays. J. Clay and H. F. Jongen. Phys. Rev. 79, 908-9(1950) Sept. 1 (Letter to the editor).

Argon (60 atm)-filled ion chambers, one unshielded, one shielded with 12 cm Fe, and one shielded with 110 cm Fe, were used to measure the variation in cosmic-ray intensity from Nov. 17 to 20, 1949. A sharp rise in intensity during the flare was most pronounced in the case of the chamber with 12 cm Fe. The decrease to normal values in all chambers lasted several hours.

6159 A Survey of the Known Properties of μ and π mesons. Nederland Tijdschr. Natuurk. 16, 59-63(1950) Mar. (in Dutch).

A brief summary is made of the properties of μ and π mesons.

6160 Wide-Angle Sprays Produced by Cosmic Radiation. R. Ronald Rau and G. G. Harris. Phys. Rev. 79, 915-17(1950) Sept. 15.

New data are presented on the wide-angle sprays, produced by cosmic radiation, which have been reported by Oppenheimer and Ney (Phys. Rev. 76, 1418(1949)). These sprays were produced in ¼-in. Pb plates in a cloud chamber sent to balloon altitudes, and 180 were selected on the basis of (a) a minimum of 6 particles, (b) an angular spread of >30 deg, and (c) lack of positive identification as an electromagnetic cascade event or a nuclear disintegration. The spray particles, presumably electrons, rarely penetrated a second ¼-in. of Pb. Initiation seemed to be by both ionizing and nonionizing particles but whether these events are produced in a single interaction or in a series of interactions in the Pb cannot be answered with the present data.

6161 A Cosmic Ray Radio Sonde. R. P. Thatte. J. Sci. Ind. Research (India) 8, No. 7, 259-70(1947).

Using radiosonde techniques, cosmic-ray vertical intensity up to 40,000 ft was recently measured at New Delhi. The radiosonde equipment used in these flights is described. It consists of a coincidence unit with a pulse lengthening circuit, a meteorograph for the pressure-temperature data, and two ultrahigh frequency light-weight transmitters to transmit the two data separately. The receiving unit consists of a superregenerative receiver coupled to a neon-coupled amplifier feeding a high-speed tape recorder for each of the channels. Using Indian-made balloons, heights of 40,000 ft were consistently reached, although the weight of the equipment was about 22 kg. In one flight, a 10 cm Pb absorber was used, and, although the total weight was then 30 kg, the flight reached a height of 60,000 ft. (auth)

6162 The Measurement of Emanating Power Using Thoron Gas in a Continuous Flow System. J. N. Gregory. Atomic Energy Research Establishment. AERE-C/R-460, Mar. 1950. 31p.

This report gives a detailed description of the technique of measuring emanating power on the thoron flow apparatus used in the Harwell laboratories. The thoron flow method was selected as being the most suitable for measurements over a wide range of temperatures, and the apparatus described here has been used for emanating power determinatives from −180°C to 1650°C. Standard electronic and recording apparatus has been adapted so that thoron activity and temperature can be continuously recorded on the same chart. This eliminates the necessity for continuous manual counting over a long period of time and also enables short period variations to be detected. Descriptions of tests carried out to determine the operating characteristics of the apparatus are also given. Such tests include consistency measurements over short and long periods, rate of build-up of active deposit background and the rate of response to changes in emanating power. The report also describes in detail several methods of calibration of the apparatus. (auth)

6163 A Method of Temperature Programme Control for Thermal Analysis. J. G. Ball and E. T. Adams. Atomic Energy Research Establishment. AERE-M/R-537, June 1950. 14p.

A method of controlling the energy input in a system to give a prearranged temperature program is described. The method involves rotation of a Variac or toroidal resistance spindle at various angular rates by means of a cam. It is particularly useful for systems of small heat capacity. (auth)

6164 Separation of the Natural Isotopes of Samarium. C. P. Keim, H. W. Savage, and Boyd Weaver. Y-640, Aug. 2, 1950. 6p.

All of the known naturally occurring isotopes of samarium have been enriched by electromagnetic separation and have been made available in milligram quantities for use in research. The samarium oxide end product is of high chemical purity, with europium the only appreciable contaminant. (auth)

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6165 The Importance of the Small. An Address Delivered at the University of Amsterdam on March 20, 1950. A. H. W. Aten, Jr. Purmerend, J. Muusses, 1950 (in Dutch).

A short survey is made of some applications of nuclear physics, such as cosmic and geologic time determinations, preparation of new chemical elements, and tracer and irradiation methods in analytical chemistry and biology. The earth's crust, the universe, and the elements seem to be older than the often accepted age of 2×10^9 years. By comparing the Pb isotopic content in various ores, Holmes and Houtermans, independently, have recently assigned to the earth's crust a minimum age of 3.3×10^9 years; as to its maximum age, another method, based on the computation of the abundance of Pb^{207}, furnished the value of 5×10^9 years. When applied to meteorites, similar reasonings assign to cosmic bodies probable minimum and maximum ages of 7×10^9 and 8×10^9 years, respectively. Very recently, Libby applied isotope physics to historic chronology by measuring C^{14} contents in dead remains of organisms (e.g. in wood objects from the pyramids of Egypt); C^{14}, produced by cosmic rays from atmospheric N, is assimilated by living plants and a certain C^{14} content is maintained until death interrupts this equilibrium. In analytical chemistry, the importance of the neutron-irradiation method is illustrated both by the Pr-Nd separation carried out on a fairly extensive scale in Amsterdam, and by the investigation, made by Harrison Brown, of the theoretically interesting fact of the rare cosmic occurrence of rhenium.

6166 Improvements in Mass Spectrometers for the Measurement of Small Differences in Isotope Abundance Ratios. C. R. McKinney, J. M. McCrea, S. Epstein, H. A. Allen, and H. C. Urey. Rev. Sci. Instruments 21, 724-30(1950) Aug.

A Nier-type mass spectrometer and its associated electronic units have been constructed for the purpose of measuring small variations in the abundances of oxygen of mass 18 and of carbon of mass 13 in carbon dioxide, and of oxygen of mass 18 in oxygen gas, to an accuracy of $\pm 0.01\%$ of the abundance of these isotopes. The electronic units of the necessary stability for this degree of accuracy are described. A gas feed system is described which permits fast alternate introduction of the sample of gas to be analyzed and a standard gas into the mass spectrometer. All measurements of the variation in the abundance of the oxygen and carbon isotopes are made with reference to a standard. (auth)

6167 Mass-Spectrometric Determinations of Argon in Potassium Salts. M. Pahl, J. Hiby, F. Smits, and W. Gentner. Z. Naturforsch. 5a, 404-5(1950) July (Note, in German).

In a study of the A^{40} method of geologic-age determinations, a mass spectrometric examination was made of argon samples obtained from sylvine and other potassium salts from two German localities and of two different ages (Oligocene and Permian). Considerable differences in the A^{40}/A^{36} ratio were interpreted as due to various degrees of air contamination of various parts of a given formation during certain events in their geologic history. The age computation was based on the assumption that the observed γ radiation is wholly due to the K-capture process (Spiers, Nature 165, 356(1950)).

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6168 Convex Bodies Associated with a Convex Body. Preston C. Hammer. AECU-932, nd. 25p.

Let C be a closed planar convex body. Let b be a boundary point of C and let r be a positive real number. $C_b(r)$ is defined as the convex body obtained by a similitude of C with center b and ratio r. For $r \leq 1$, C(r) is defined so that $C(r) = \pi_b C_b(r)$ and for $r \geq 1$, $C(r) = \sum_b C_b(r)$ where b varies over all boundary points of C. Let x be an interior point of C and let r(x) be the maximum ratio into which x divides any chord of C passing through it. The ratio is taken as the larger part divided by the whole chord. Then it is known that r(x) reaches a minimum value r^* at a unique point x^*. Some results are as follows: (1) C(r) is a closed convex body, $C(r) = 0$ for $r < r^*$, $C(r_2)^* = x^*$, $C(r_1) \supset C(r_2)$ for $r_1 > r_2$, and the boundaries of C(r) simply cover the entire plane. (2) For $r < 1$, the boundary of C(r) consists precisely of those points x of C such that $r(x) = r$. (3) For $r > 1$, C(r) is the minimal convex body such that the maximum ratio into which boundary points of C divide chords of C(r) is $\frac{r}{2r-1}$. Any diameter of C determines a diameter of C(r) by expansion about its midpoint with a ratio $2r-1$. (4) The sets C(r) are affine invariants. Let $B = C(r)$ for $r < 1$. C is completely reducible if $B\left(\frac{r}{2r-1}\right) = C$ for every r between r^* and 1. C is reducible to a ratio r_1 if $B\left(\frac{r_1}{2r_1-1}\right) = C$, but $B\left(\frac{r}{2r-1}\right) \neq C$ for $r < r_1$. If $r_1 = 1$, then C is irreducible. Then the following results are obtained: (5) C is completely reducible if, and only if, its boundary is a central curve ($r^* = \frac{1}{2}$) and then the bodies C(r) are obtained from C by similitudes about the central point x^*. (6) If $r^* > \frac{1}{2}$ then there exists a unique ratio $r_1 > r^*$ to which C is reducible. The body $C(r_1)$ is irreducible. (auth)

6169 Alpha Particle Detection and the A. C. Operated Detector "A" (Howler). Hugh G. Neil. AECD-2927, Jan. 29, 1946. Decl. Sept. 5, 1950. 17p.

This discussion concerns the operation, construction, and servicing of an alpha rate meter of medium sensitivity (30,000 alpha particles full scale per minute) and good stability. The instrument is equipped with an oscillator which increases both in frequency and loudness as the alpha activity is increased. The oscillatory circuit includes an anticipator which causes a change in frequency depending directly upon the rate of change of alpha activity. Maximum sensitivity is approximately 100 millivolts full scale. Grid current varies from 1 to 5×10^{-14} amp. A general discussion of time constants and accuracy is included. Tables of stopping power, ionization, and alpha activity are appended. (auth)

6170 An Electronic Scanner for Photographic Plates. D. T. Williams. BMI-T-33, Aug. 1, 1950. 36p.

The design and construction of a device to scan nuclear emulsions by using a photomultiplier tube and preliminary tests of the equipment are described.

6171 Counter Calibrations in the Health Instrument Methods Group. J. W. Healy, L. C. Schwendiman, and R. C. Thorburn. HW-18258, July 1, 1950. 53p.

The authors report the results of studies made to provide methods to measure accurately activities which may then be used to evaluate the over-all yield of an analysis. Some of the topics discussed are counting geometry, backscattering corrections, and self absorption of β rays.

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6172 Operation and Design of an End Window Alpha Scintillation Counter for Low Counting Rates. Clifton W. Reed. UCLA-85, Aug. 14, 1950. 16p.

An alpha scintillation counter is described employing an RCA 5819 end window photomultiplier tube, scintillating screen of powdered zinc-cadmium sulfide on scotch tape, counter chamber, scaler, and register complete in one unit. Operation and design has been standardized as much as possible to conform with standard G-M counter practices. Proper operating conditions are established by plateau plotting. Special arrangements and methods of sample preparations will allow geometries of 64%. Normal production samples are prepared in a shallow 1½-in. diameter stainless steel cup. The cup gives a 23% geometry at a 0.65 cm sample-to-screen spacing. Background counting rates of 2 to 3 cts/hr are normally encountered with a 2¼-in. diameter screen. Special sample and screen arrangements allow backgrounds of 1 ct/hr or less. This instrument has been used extensively in health physics, soil chemistry, and dust studies. (auth)

6173 An Anomalous Effect Observed in Self-Quenching Counters Containing Neon. A. D. Krumbein. Phys. Rev. 79, 910(1950) Sept. 1 (Letter to the editor).

Counters filled to 10 cm total pressure with neon-quenching constituent mixtures, containing less than 0.1% of ethyl acetate or butane, exhibited a Geiger plateau region at a higher voltage across the counter than a preceding region of continuous discharge. The counter characteristics from this point on were observed to follow the usual pattern. As the partial pressure of the quenching constituents was decreased below the point where the foregoing phenomenon set in, the continuous discharge region preceding the plateau became longer while the plateau itself grew shorter, until the latter completely disappeared. The effect was most striking with ethyl acetate, and less so with butane. It also occurred to a limited extent with methane, though at a higher partial pressure of this quenching gas. The influence of cathode area on this effect is discussed.

6174 BF_3-Filled Neutron Counters. A. Bracci, U. Facchini, E. Germagnoli, and E. Zimmer. Nuovo cimento 7, 512-19(1950) July 2 (in Italian).

Details are given of the construction of cylindrical (brass pipe) neutron counters filled with BF_3 or with mixtures of A and BF_3. The preparation of BF_3 from KBF_4, and the filling operation, are also described. A study was made of such characteristics of the counters as the dependence of the multiplication factor M on the applied voltage V (M grows faster in the case of mixtures A + BF_3 than with BF_3 alone), the number of pulses as a function of V, the bias curves (mixtures are more satisfactory than BF_3), the pulse energy spectrum at various V (showing the two states of Li^7). Some tests were made of a spherical-cathode counter of the type described by Salvini (Ricerca sci. e ricostruz. 19, 914(1947)).

6175 Boron Trifluoride Proportional Counters. I. L. Fowler and P. R. Tunnicliffe. Rev. Sci. Instruments 21, 734-40(1950) Aug.

Boron trifluoride proportional counters of calculable efficiency for neutron beam measurements are described. It has been found possible to obtain excellent pulse-size distributions with a filling of 60 cm of purified BF_3 by "soaking" the counters for a long time (up to three months) with BF_3 before putting in the final filling. These fillings are stable. Fillings of less than 5 cm BF_3 made up to 50 cm with argon have also been studied. With these fillings the pulse-size distributions are very good for both beam and total irradiation conditions. A discussion of the counter efficiencies with particular reference to end correction is given. (auth)

6176 The Chalk River Single Crystal Neutron Spectrometer. D. G. Hurst, A. J. Pressesky, and P. R. Tunnicliffe. Rev. Sci. Instruments 21, 705-12(1950) Aug.

A single crystal neutron spectrometer has been constructed which shows improvement in resolution and intensity over previously described instruments. This has been made possible by the high flux available from the Chalk River heavy water reactor. The instrument can be operated automatically. Mechanical design, crystals, resolution, and the contamination of the spectrum by higher orders are discussed. (auth)

6177 A Counter for Measuring Range Curves of α Emitters. B. Gysae. Z. Naturforsch. 5a, 403-4(1950) July (in German).

An α-ray counter is described in which the number of manipulations, when establishing a range curve, is comparatively small. The preparation tested is placed on the inside of a cylindrical glass wall concentric with the counter. A glass cylinder (for the checking of the zero point), and a support carrying a cylindrical aluminum foil (or two on opposite sides of the support) can be pushed in between the emitter and the counter without opening the apparatus. For every given gas pressure, three curve points can thus be determined.

6178 Counting Systems. Atomics (London) 1, 251-61 (1950) Sept.

Accessory components for a counting system are discussed, with particular reference to the G-M system. The exact function of each component is stated, and details are given of the electrical characteristics which should be considered when purchasing apparatus of this kind. Sources of supply of this accessory apparatus, both in England and in North America, are given in an appendix.

6179 The Design of a Magnetic Focusing Coincidence Spectrometer. C. M. Fowler and R. G. Shreffler. Rev. Sci. Instruments 21, 740-6(1950) Aug. (See also NSA 4-2025.)

Design and operating features are described for a semicircular magnetic focusing coincidence spectrometer. The primary function of the spectrometer is that of determining whether or not two different radiations from a radioactive sample are in the same branch of the nuclear decay scheme. Although the instrument is designed primarily for studies between conversion electron groups, it is also suitable for studies between conversion groups and beta spectra. A feature of the instrument is its extraordinarily good coincidence resolving power. Applications of the spectrometer to two activities are briefly discussed, and an explanation of the high resolving power is given. (auth)

6180 Gamma-Ray Spectroscopy with Crystals of NaI(Tl). Robert Hofstadter and John A. McIntyre. Nucleonics 7, No. 3, 32-7(1950) Sept.

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The theory of NaI(Tl) crystals and associated electronic equipment used to determine γ-ray spectra is discussed briefly. In addition, the results obtained with Co^{60}, K^{40}, Ga^{68}, Na^{24}, and Au^{198} are described.

6181 High Pressure Ionization Chamber Counters and Their Use. R. Wilson, L. Beghian, C. H. Collie, H. Halban, and G. R. Bishop. Rev. Sci. Instruments 21, 699-705(1950) Aug.

New developments in ionization chamber technique are described. Ionization chamber counters have been designed to operate with fillings of H_2, D_2, or CH_4 to pressures of 35 atm with simple filling techniques. The design, characteristics, and uses of these counters are described. 19 references. (auth)

6182 Hydrogen-filled Geiger Counters. B. Collinge. Proc. Phys. Soc. 63B, 665-74(1950) Sept. 1.

Permanent gas counters are discussed and a new quenching circuit is described. Quenching times of about 45 μsec have been used and plateaus with slopes better than 0.05% per volt obtained. A formula for the correction of counting rates for losses caused by the counter dead-time has been confirmed within wide limits. It has been found possible to measure counting rates as high as 5×10^5 cts/min with an accuracy closer than 1%. (auth)

6183 On the Photoelectric Effect in External-Cathode Counters. Armando Dias Tavares. Rev. cient. 1, 43-47(1950) May 30 (in Portugese).

Experiments on the photoelectric effect in external-cathode counters showed that for visible light the effect is caused by impurities deposited on the inner surface of the glass wall, while for the ultraviolet radiations the variations of the photoelectric effect seem to be due to some chemical changes in the glass itself.

6184 A Photographic Method for Determining Half-Lives. E. Rabinowicz. Proc. Phys. Soc. (London) 63A, 1040-1(1950) Sept. 1 (Letter to the editor).

A method is described similar to that of Zuber (Helv. Phys. Acta 21, 365(1948)), who compared the intensities of blackening produced by placing a radioactive metal on a photographic film at different times during its decay. The exposure times were so chosen from a previous knowledge of the approximate half-life that the images were of roughly the same degree of blackness. Using this procedure, the half-life of Cu^{64} was measured to be 12.80 ± 0.40 hr.

6185 The Photomicrography of Nuclear Tracks. Ida Tschiderer. PSA Journal 16 B, 43-6(1950) June.

Several photographs of nuclear events are reproduced and a short description is given of the photomicrography techniques employed in their preparation.

6186 Random Coincidence Rates with Unsteady Sources. R. M. Littauer. Rev. Sci. Instruments 21, 750-2 (1950) Aug.

The random coincidence rate between two sets of pulses can be measured by delaying one of the sets through a time greater than twice the resolving time of the coincidence detector, thus destroying all true coincidences. A circuit using this principle for supervising the random rate continuously is described. (auth)

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6187 Response of G-M Counters and Photographic Emulsions to High-Energy Photons. Gerald J. Hine. Nucleonics 7, No. 4, 18-26(1950) Oct.

Data are given showing the relative variation of the photographic response of film exposed to x-radiation up to a maximum photon energy of 10 Mev. The photographic emulsion was surrounded by low and high atomic number materials, corresponding to the different cathode materials of G-M counters. The intensifying action of high-Z materials for photons with energies between 0.5 and 10 Mev is calculated and compared with the experimental results. A method for the calibration of the film response is indicated.

6188 Scintillations from Naphthalene-Anthracene Crystals. J. B. Birks. Proc. Phys. Soc. (London) 63A, 1044-6 (1950) Sept. 1 (Letter to the editor).

A range of naphthalene crystals, each about 2 cm diameter and 1 cm thick, has been prepared, containing various concentrations of anthracene, and the scintillations excited in these by Po α particles have been investigated. The fluorescent emission from the mixed crystals contains two spectral components, 3100 to 3700 A characteristic of naphthalene, and 4000 to 5000 A characteristic of anthracene. The intensities of the two have been measured independently by introducing suitable filters between the crystal and the phototube. The average pulse sizes under α excitation were observed and compared with those from pure naphthalene and pure anthracene under the same conditions. The total intensities, obtained by adding the relative proportions of each component, agreed within 2% with the values obtained from the previous direct observations. The results are consistent with the "exciton" theory proposed by Bowen et al (Proc. Phys. Soc. (London) 62A, 26(1949)) to account for similar phenomena observed under ultraviolet excitation.

6189 Sensitivity of an Aluminium Ionization Chamber for X-radiation. B. H. Flowers, E. B. Fossey, and S. J. Roberts. Atomic Energy Research Establishment. AERE-TR-543, July 1950. 20p.

The sensitivity of detection of an aluminum-walled ionization chamber is calculated taking into account Compton scattering up to second-order for the range of x-ray energies from 0.1 to 50 mc^2 and thicknesses 5, 7.5, and 10 cm of aluminum. The second-order scattering is found to be a small correction everywhere and higher order corrections can be neglected. (auth)

6190 A Simple Differential Pulse-Height Analyzer. Kenneth I. Roulston. Nucleonics 7, No. 4, 27-9(1950) Oct.

An analyzer circuit was designed for use with scintillation counters to take advantage of their short pulse duration. The analyzer consists of only three tubes for each amplitude level. The over-all arrangement is quite conventional. The discriminators employ a conventional type of two-tube trigger circuit. The anticoincidence circuit for each channel consists of a phase-inverter and two resistances. A cathode-follower is made available by using one-half of the phase inverter double-triode. Thus, for a ten-channel differential discriminator, a total of 33 tubes is necessary, exclusive of power supply and scalers.

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6191 The Study of Atomic Processes with the Photographic Plate. H. K. Heitler and D. T. King. Experientia 6, 281-90(1950) Aug.

A review of the use and properties of photographic emulsions in the detection of nuclear particles is presented.

6192 Temperature Dependence of Counter Characteristics in Self-Quenching Geiger-Mueller Counters. W. R. Loosemore and Denis Taylor. Proc. Phys. Soc. (London) 63B, 728-9(1950) Sept. 1 (Letter to the editor).

The effect of temperature changes on the threshold voltage, plateau length, and plateau slope of a counter with an internal metal cathode and one with an internal graphite cathode was measured. The results confirm the findings of Parkash and Kapur (Proc. Phys. Soc. (London) 63B, 461(1950)). The temperature coefficient, defined as the average change of threshold voltage per degree centigrade, is higher for the graphite-cathode counter than for the metal-cathode counter. This is to be expected, since the adsorption of alcohol vapor by a graphite surface is very temperature-dependent. Tests have also been made using the Maze (J. phys. radium 7, 164(1946)) type of counter with an external cathode on the outside of a glass envelope. The temperature coefficient obtained was very low as compared with that obtained with the internal-cathode type of counter, as also reported by Parkash and Kapur. It was noted that the performance was markedly affected by the electrical resistance of the glass. In practice, the electrical resistance of the glass becomes too high at low temperatures to allow this type of counter to operate. The authors suggest that if low-temperature operation is required, it is better to use a counter with an internal cathode, but with a quenching agent other than ethyl alcohol.

6193 Theory of the Luminescence of Sulfide Phosphors. Shepard Roberts and Ferd E. Williams. J. Optical Soc. Am. 40, 516-20(1950) Aug.

Assuming the existence of a killer center with an unoccupied electronic ground state above the Fermi level and explicitly including the metastable emitting state of the activator and the electron traps in the formulation, the dependence of emission intensity on excitation intensity for sulfide phosphors is comprehensively treated. The data of Nail, Urbach, and Pearlman, (J. Optical Soc. Am. 39, 690(1949)), which demonstrate that over an intensity range the emission intensity of the $Zn_{0.5}Cd_{0.5}S$:Ag, Ni phosphor is proportional to the 3.5 power of the excitation intensity, are quantitatively reproduced by the theory. The adjustable parameters used to fit the data are shown to be reasonable and to be in accord with other measurements and are used to evaluate the energies of the various electronic states involved. In addition, it is shown that the relation of Klasens and Wise (J. Optical Soc. Am. 38, 226(1948)) between excitation and emission intensity may be derived as a special case of the general theory. (auth)

6194 Report of Visit to Brookhaven National Laboratory. Maynard E. Smith. TID-367, May 17, 1950. 6p.

Comments regarding a discussion on the meteorological aspects of atmospheric diffusion are made.

6195 Nuclear Shielding Studies. VIII. The Detection of Fast Neutrons by Means of Threshold Reactions. R. M. Kiehn. MIT Laboratory for Nuclear Science and Engineering Technical Report No. 40, May 5, 1950. 28p. (AEC File No. NP-1509.)

A summary of the literature of the applications and characteristics of threshold detectors for fast neutron measurements has been made. In order to facilitate further computations and to give orders of magnitude of the excitation function for n,p and n,α endoergic reactions, the Gamow Penetratibility, P_0, for the reactions $P^{31}(n,p)Si^{31}$, $S^{32}(n,p)P^{32}$, $Al^{27}(n,p)Mg^{27}$, $Si^{28}(n,p)Al^{28}$, $P^{31}(n,\alpha)Al^{28}$, $Fe^{56}(n,p)Mn^{56}$, $Al^{27}(n,\alpha)Na^{24}$, has been computed. P_0 is the basis for threshold work, but must be corrected for higher angular momentum terms ($l > 0$), when actual yield functions for charged particle reactions are to be computed. 29 references. (auth)

6196 Thermal Equilibrium in Neutron-Irradiated Semiconductors. J. H. Crawford, Jr. and K. Lark-Horovitz. Phys. Rev. 79, 889-90(1950) Sept. 1 (Letter to the editor).

The conductivity versus irradiation curves of Ge semiconductors exposed to fast and thermal neutron flux in the Oak Ridge pile were analyzed. The results indicate that the decrease in electron concentration in N-type Ge is of the order of 3 per incident fast neutron, but that the increase in hole concentration in P-type Ge is much smaller. Additional experiments show that, depending on temperature, 0.6 to 0.8 of a carrier is released initially per incident neutron. In all experiments on N-type Ge carried out in the reactor and, therefore, subject to β and γ radiation, the maximum resistivity reached during bombardment is smaller than the predicted value, which should be even greater than that of intrinsic Ge due to the additional introduced scattering centers. It is concluded that in high resistance material, measured in the pile, photoeffects due to ionizing radiations do play an important part. These increase the conductivity and must be considered in the theoretical interpretation of the "in pile" conductivity measurements on Ge.

6197 The Uniqueness Theorem for an Integro-Differential Equation Describing the Diffusion of Thermal Neutrons in Paraffin. Gino Goldoni. Atti seminar. mat. fis. Modena 3, 138-41(1949)(in Italian).

Pignedoli (Atti seminar. mat. fis. Modena 2, (1948)) has discussed the problem of the integration of the equation describing the diffusion of slow neutrons in hydrogen-containing substances. The present author proves the uniqueness of the solution of that equation.

6198 On Nuclear Quadrupole Moments. R. Sternheimer. AECU-923, nd. 4p.

The hyperfine splitting due to the nuclear quadrupole moment includes the effect of an electric quadrupole moment induced in the electron shells. Using the Fermi-Thomas model, this effect is calculated for B, Al, Sc, Ga, In, Eu, Lu, and Ac.

6199 Stopping Power and Energy for Ion Pair Production for 340-Mev Protons. C. J. Bakker and E. Segrè. UCRL-850, Aug. 3, 1950. 19p.

The relative stopping powers for 300-Mev protons of H, Li, Be, C, Al, Fe, Cu, Ag, Sn, W, Pb, and U have been measured. The energy spent per ion-pair production in the gases H_2, He, N_2, O_2, and A at 340-Mev proton energy has also been measured. The results are shown in tabular form. 10 references. (auth)

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6200 Neutron Binding Energies. J. R. Huizenga, L. B. Magnusson, O. C. Simpson, and G. H. Winslow. Phys. Rev. 79, 908(1950) Sept. 1 (Letter to the editor).

Whereas the determination of neutron binding energies by either a (d,p) or (d,t) reaction alone gives ambiguous results, agreement between the calculations using both (d,p) and (d,t) data for a nucleus removes all ambiguity. Several lead and bismuth isotopes are discussed specifically.

6201 Precision Determination of Nuclear Gyromagnetic Ratios. E. W. Guptill, W. J. Archibald, and E. S. Warren. Can. J. Research 28A, 359-66(1950) July.

The ratio of the Larmour frequency of precession for hydrogen and fluorine, and for sodium and aluminum have been measured with an accuracy of one part in 10^5:

$$\nu_H/\nu_F = 1.062917 \pm 0.00001$$
$$\nu_{Na}/\nu_{Al} = 1.015081 \pm 0.00001$$

These ratios are corrected for the atomic diamagnetism giving for γ the nuclear gyromagnetic ratios:

$$\gamma_H/\gamma_F = 1.06245 \pm 0.00002$$
$$\gamma_{Na}/\gamma_{Al} = 1.01494 \pm 0.00002$$

A brief description is given of the relevant equipment used in obtaining these measurements. (auth)

6202 Some Remarks on the Quasi-atomic Model and Nuclear Magnetic Moments. Robert Bouchez. Compt. rend. 231, 275-7(1950) July 24 (in French).

Schmidt (Z. Physik 106, 358(1937)) has calculated magnetic moments μ of nuclei of odd A from their total quantum number J by assuming the existence of two nuclear parts, viz., a saturated even-even part (J = L = 0), and a nonsaturated one consisting of only one nucleon. However, the agreement with the experimental values of μ is not quite satisfactory. By making different hypotheses, the present author arrives at configuration mixtures that lead to a better agreement between calculated and measured values of μ. He assumes that $J = \mu = 0$ for the saturated part, and that the nonsaturated part may consist of one, two, or three nucleons.

6203 On Spin Dependent Nuclear "Radii." C. O. Muehlhause. Phys. Rev. 79, 1002(1950) Sept. 15 (Letter to the editor).

In applying the Breit-Wigner scattering formula to low-energy neutron scattering ($J = I \pm \frac{1}{2}$) the nuclear radius, R, enters as a potential scattering amplitude. At thermal energies the total scattering cross section, σ_S, is given by

$$\sigma_S/4\pi = g_+ \left| R + a_+ \right|^2 + g_- \left| R + a_- \right|^2$$

where the + and - refer to states having total angular momenta J_+ and J_-, respectively. The a_+ and a_- are sums of all resonance amplitudes of states having J_+ and J_-, respectively, and the g_+ and g_- are statistical weight factors corresponding to the J. It is possible that the apparent size of the nucleus (i.e., R, the range of the infinitely repulsive potential) may depend upon the incoming neutron spin orientation. This would yield an R_+ and an R_- and require σ_S to be given by

$$\sigma_S/4\pi = g_+ \left| R_+ + a_+ \right|^2 + g_- \left| R_- + a_- \right|^2.$$

Similarly, the incoherent (spin effect) thermal scattering cross section, σ_{inc}, would be given by

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$$\sigma_{inc}/4\pi = g_+ g_- \left| R_+ + a_+ - R_- - a_- \right|^2$$

It is thought that the radius appearing in the resonance formula may not, in general, be given by the $A^{1/3}$ rule or even be given uniquely; rather, it should be treated as a double parameter. (auth)

6204 On the Energy Distribution of the Fission Fragments of U^{235} Produced by 2.5-Mev and 14-Mev Neutrons. Stephen S. Friedland. AECU-929, Mar. 10, 1950. 10p.

The method used in this experiment was to compare the ionization produced by the fission fragments to the ionization produced by alpha particles of known energy. A fission chamber similar to the one described by Fowler and Rosen (Phys. Rev. 72, 926(1947)) was used. For the 14-Mev neutrons, the $H^3(H^2,n)He^4$ reaction was used, while for the 2.5-Mev neutrons, the $H^2(H^2,n)He^3$ reaction was used. Results show that the depth of the valley between the two energy peaks decreases with increasing energy and also that the ratio of the two peak heights approaches unity with increasing neutron energy.

6205 Abnormal Charge Increase in Nuclear Reactions. Luis Marquez. UCRL-667, Apr. 24, 1950. 28p.

Antimony (57% Sb^{121}, 43% Sb^{123}) was irradiated with α particles of various energies and the yields of iodine ($I^{120,121,122,123,124}$) from the (α,xn) were determined. In addition, tin was irradiated with protons and α particles (~350 Mev) and the activities of $I^{120,121,123,124,126}$ were observed. Bombardments were made with lower energies and a threshold of about 50 Mev was estimated for the reactions. Results indicate that to a first approximation the reaction is not very sensitive to the nature of the bombarding particle, but depends only on the energy and the excitation function. The following mechanism is suggested:

$$_{50}Sn + \underset{\alpha}{p} - \text{fragments} + {}_3Li$$

$$_{50}Sn + {}_3Li - {}_{53}I.$$

6206 An Experimental Verification of the Theory of Compound Nucleus. S. N. Ghoshal. UCRL-709, Rev., July 14, 1950. 17p.

The compound nucleus Zn^{64} was formed by bombarding Ni^{60} with α particles and Cu^{63} with protons. The ratios of the cross sections $\sigma(\alpha,n):\sigma(\alpha,2n):\sigma(\alpha,pn)$ for Ni^{60} were found to agree with the ratios $\sigma(p,n):\sigma(p,2n):\sigma(p,pn)$ for Cu^{63}, giving a direct verification of the theory of compound nucleus. The observed cross sections for the (p,n), (p,2n), and (p,pn) reactions on Cu^{63} and (α,n), (α,2n), and (α,pn) reactions on Ni^{60} have been compared with the theoretical cross sections calculated on the basis of the statistical model. The observed anomalous behavior of the (p,pn) and (α,pn) cross sections with respect to the (p,2n) and (α,2n) cross sections, respectively, are discussed. (auth)

6207 Fast Neutrons from the T + D and T + Li Reactions. E. Almqvist. Can. J. Research 28A, 433-48(1950) July.

The fast neutrons produced by the triton bombardment of LiF, Li_2CO_3, $LiOH \cdot H_2O$, LiOD, and $LiOD \cdot D_2O$ have been detected, and the thick target yields and their slowing down lengths in graphite have been measured. The tritons were produced by irradiating the compounds in the high thermal

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neutron flux of the thermal column of the NRX pile. The spatial distributions of the fast neutrons from the T + D and T + Li reactions were measured in the graphite with indium resonance detectors. The numbers of fast neutrons emitted per second were obtained by comparing the space integrals of the indium activity with those measured when a standard Ra-α-Be source of neutrons was in the position of the lithium compounds. The number of incident tritons was estimated from the measured flux of thermal neutrons at the lithium compound and the total capture cross section of the lithium. The thick target yields were thereby derived. The average cross sections for neutron production by 2.6 Mev tritons are 1.5×10^{-24} cm^2 per atom of lithium and 0.41×10^{-24} cm^2 per atom of deuterium. The slowing down lengths in graphite of density 1.64 g/cc are 19.2 and 23.4 cm for the neutrons from the lithium and deuterium, respectively. The smallness of the latter indicates that inelastic scattering of these 14-Mev neutrons occurs in graphite. 21 references. (auth)

6208 Magnetic Analysis of the $B^{10}(p,\alpha)Be^7$ Reaction. D. M. Van Patter, A. Sperduto, E. N. Strait, and W. W. Buechner. Phys. Rev. 79, 900-1(1950) Sept. 1 (Letter to the editor).

A search was made for α groups from the reaction $B^{10}(p,\alpha)Be^7$ corresponding to the 205- and 745-kev levels reported by Grosskreutz and Mather (Phys. Rev. 77, 580 (1950)). The α particles emitted at 90 deg to the incident beam were analyzed by a high resolution magnetic spectrometer employing 180-deg focusing and detected by means of nuclear track emulsions. At 1.790-Mev bombarding energy, two α groups were found, corresponding to the ground state of Be^7 and an excited state at 431 kev. The Q-values of the two α groups were determined to be 1.152 ± 0.004 and 0.721 ± 0.006 Mev, corresponding to the ground state of Be^7 and an excited state at 431 ± 5 kev. The observation of the proton group elastically scattered from the B^{10} at 1.790-Mev bombarding energy permits the estimation of the relative yields of the $B^{10}(p,\alpha)Be^7$, $B^{10}(p,\alpha)Be^{7m}$, and $B^{10}(p,p)B^{10}$ groups which were in the ratio of 1.0:0.4:10. It may be concluded that there is no indication that levels in Be^7 at 205 and 745 kev are excited by the $B^{10}(p,\alpha)Be^7$ reaction at the bombarding energies used.

6209 Neutron Cross Sections of the Elements. Robert K. Adair. Revs. Mod. Phys. 22, 249-89(1950) July.

Much of the available data on the neutron cross sections (mainly total cross sections) of the elements in the thermal and higher energy regions (in some cases up to 300 Mev) is presented. In addition a review of some of the basic theory (compound nucleus, potential scattering, temperature model of the excited nucleus, high energy transparency effect) is given.

6210 The Photo-Disintegration of the Deuteron. Ingvar F. E. Hansson. Phys. Rev. 79, 909-10(1950) Sept. 1 (Letter to the editor).

The photomagnetic and photoelectric cross sections of the deuteron have been calculated for a γ energy of 2.52 Mev, using different values of the binding energy, 2.19 and 2.24 Mev, and ranges equivalent to meson masses of 200 and 300. This is a continuation of the work, reported by Hansson and Hulthén (Phys. Rev. 76, 1163(1949)) and listed

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in Nuclear Science Abstracts as abstract 4-804, on γ energies of 2.62, 2.76, and 6.2 Mev.

6211 The Reaction $C^{14}(n,\gamma)C^{15}$. L. Yaffe and W. H. Stevens. Phys. Rev. 79, 893(1950) Sept. 1 (Letter to the editor).

Normal and C^{14}-enriched carbons were bombarded with neutrons in the Chalk River pile. No activity was detected which could be ascribed to C^{15}. Lithium was bombarded under identical conditions and the resulting Li^8 observed. This is a β emitter with a half-life of 0.88 sec and a maximum energy of 12.7 Mev. Using the value of 33 millibarns for the reaction $Li^7(n,\gamma)Li^8$, limits were set for the capture cross section of C^{14}. If the half-life of C^{15} is 2.4 sec (Hudspeth, Swann, and Heydenburg, Phys. Rev. 77, 738(1950)), then the cross section of C^{14} for thermal neutron capture must be less than 1 microbarn.

6212 Resonators for the 300-Mev Berkeley Synchrotron. Mitchell Dazey. UCRL-707, June 5, 1950. 61p.

Design specifications and calculations are presented. Construction, tests, and operation of resonators are described. Emphasis is placed on calculations of Q losses and frequency swinging, preparation and electroplating of quartz resonators, Q measurements, and tests of vacuum seals. 10 references.

6213 Focusing in Linear Accelerators. Edwin M. McMillan. UCRL-880, Aug. 24, 1950. 6p.

Mathematical proof that phase stability and first order focusing are incompatible in a simple linear accelerator (without foils or grids in the path of the particles), regardless of more complicated field shapes and time variations to circumvent this limitation, is given.

6214 Acceleration of Stripped C^{12} and C^{13} Nuclei in the Cyclotron. J. F. Miller, J. G. Hamilton, T. M. Putnam, H. R. Haymond, and G. B. Rossi. UCRL-881, Aug. 25, 1950. 8p.

Detectable intensities of completely stripped C^{12} and C^{13} ions have been observed. A hooded capillary ion source gave the best results. The source gas for the production of carbon ions was CO_2. Range determinations using aluminum absorbers were made and the data are summarized, giving the measured and expected range-energy relationships. Internal targets of Al and Au were bombarded. The 33-min positron-emitting Cl^{34} and the 24-min At^{208}, were chemically isolated and identified by their radiations and half-lives.

6215 Applications of the Radiation from Fast Electron Beams. H. Motz. Stanford University Microwave Laboratory, July 1950. 39p. (AEC File No. NP-1692.)

It is shown that the entire spectrum of electromagnetic radiation, from microwaves to hard x-rays, may be easily obtained from electrons with speeds ranging from a megavolt to 1000 Mev. Several applications are discussed under the following headings: (1) production of energy in rather inaccessible spectral bands, viz., millimeter to infrared radiation, (2) speed monitoring for electron beams produced by linear or other accelerating devices, (3) speed measurement for fast individual electrons or other particles (mesons, protons). The radiation emitted by an

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electron moving through an electromagnetic wave traveling in the opposite direction is also considered briefly. This occurs in a linear accelerator in which a wave is reflected from the output end and travels back to the starting section. (auth)

6216 The Birmingham Proton Synchrotron. L. U. Hibbard. Nucleonics 7, No. 4, 30-43(1950) Oct.

The 1-Bev proton synchrotron under construction at Birmingham University is described in some detail. With a magnet radius of 16 ft, the radius of the stable orbit will be 450 cm. Protons are to be injected at 500 kev and accelerated, through 7×10^5 revolutions, to a maximum of 1.3 Bev.

6217 The Harvard University 95-Inch Cyclotron. Design, Construction, and Preliminary Operating Instructions. W. G. Cross, L. L. Davenport, H. I. Ewen, R. J. Grenzeback, R. B. Holt, L. S. Lavatelli, R. A. Mack, A. J. Pote, N. F. Ramsey, L. G. Ritner, F. B. Robie, and P. G. VanHeerden. Harvard University. July 1950. 358p. (AEC File No. NP-1698.)

A detailed outline of the design, construction, and preliminary operation is presented. Chapters on the cyclotron building and facilities, magnet, cyclotron orbits, radio-frequency system, variable condenser, cyclotron vacuum system, personnel protection, and arc sources and probes are included. Coil specifications, miscellaneous control circuits, radiation safety precautions to be observed, and notes on the atomic instrument linear amplifier are given in appendixes.

6218 Voltage Stabilizer for 200-Kv Acceleration. J. T. Dewan. Rev. Sci. Instruments 21, 771-2(1950) Aug. (Laboratory and shop note).

A circuit to stabilize the accelerating voltage despite 1% changes in the a-c supply voltage is described. A stabilization ratio of 40 is achieved.

6219 Multiple Scattering of the Particles Producing the "Positive Tracks" Appearing Near Beta-Ray Emitters. Gerhart Groetzinger and Fred L. Ribe. Phys. Rev. 79, 904-5(1950) Sept. 1 (Letter to the editor).

The multiple scattering of 20 tracks of light particles from P^{32}, with a curvature in a magnetic field corresponding to positively charged particles (positrons are ruled out by energy considerations), was compared with that of electron tracks. The authors state that particles with a mass equal to 2 m_e fit the scattering data for the positive tracks.

6220 Scattering of Positrons and Electrons by Nuclei. H. J. Lipkin and M. G. White. Phys. Rev. 79, 892-3(1950) Sept. 1 (Letter to the editor).

According to relativistic quantum mechanics, there is a marked difference between the nuclear scattering of positrons and of electrons because of the manner in which spin-orbit coupling enters into the calculation. A comparison of the scattering of electrons and positrons by light and heavy nuclei is thus a check on relativistic quantum mechanics and on the spin of the positron. To check the theoretical predictions by Mott (Proc. Roy. Soc. (London) 124A, 425 (1929)) and Massey (Proc. Roy. Soc. (London) 181A, 14 (1942)) an experiment was performed to measure the scattering of positrons and electrons by polystyrene, copper, and platinum. Results are in approximate agreement with the theory. The authors believe that the discrepancy exists because the scattering calculations did not include screening.

6221 Upper Limit on the Cross Section for the Scattering of Neutrinos. J. H. Barrett. Phys. Rev. 79, 907-8 (1950) Sept. 1 (Letter to the editor).

An attempt was made to detect the scattering of tritium neutrinos by the electrons of (1) a neon-filled Geiger counter, and (2) a helium-filled Geiger counter. An upper limit to the cross section was found to be 6×10^{-33} cm^2/electron in case (1), and 4×10^{-34} cm^2/electron in case (2).

6222 The Radioactivity of Am^{242}. G. D. O'Kelley, G. W. Barton, Jr., W. W. T. Crane, and I. Perlman. AECD-2916, July 18, 1950. Decl. Aug. 22, 1950. 5p.

The radioactivity of Am^{242} obtained by the neutron irradiation of Am^{241} has been analyzed by a bent crystal x-ray spectrometer (for the L x-ray mixture) and a 255-deg shaped magnetic field β-ray spectrometer with a resolution of 3%. Two isomers of Am^{242} resulted, Am^{242m} with 16-hr half-life known to decay by β^- emission, and a long-lived ground state, Am^{242}, which is also a β^- emitter and has weak alpha branching. When the irradiated Am^{241} was observed with the x-ray spectrometer, L-series x-rays of Cm, Am, Pu, and Np were identified among which the $L\beta_1$, $L\beta_2$, $L\alpha_1$, and $L\gamma_1$ lines were in greatest abundance. The Fermi-Kurie plot of the continuous β^- spectrum of Am^{242m} showed an end point of 628 ± 5 kev. Two sets of L conversion lines were seen corresponding to gamma rays of 38 and 52 kev. The former was assumed to be a plutonium γ ray, and the latter was assumed to be from americium. Lead and copper absorption curves showed no hard γ rays or K x-rays and only the 50-kev soft γ ray. When compared with the abundance of the conversion electrons, this γ ray appears to be about 50% converted. From arguments based on relative abundances of x-rays, conversion electrons and the β^- particles, Am^{242m} appears to decay about 60% by β^- emission, 20% by L-electron capture, and 20% by isomeric transition. All three of the modes of decay give rise to L-series x-rays. The β^- particle of the ground state of Am^{242} has also been measured, but the accuracy of the end point has not yet been determined with desirable accuracy. The value obtained is 580 ± 30 kev which is consistent with the supposed 52 kev associated with the isomeric transition of Am^{242m}.

6223 A Note on Neutron Deficient Europium Activities. Geoffrey Wilkinson and Harry G. Hicks. UCRL-872, Aug. 16, 1950. 6p.

Brief comments on the production and decay characteristics of the 15h, 27h, 14d, and 54d europium activities are made.

6224 Mass Assignment of Natural Activity of Samarium. Boyd Weaver. Y-639, Aug. 2, 1950. 6p.

Measurement of radioactivity from milligram quantities of enriched samarium isotopes has definitely shown that the natural alpha activity of this element comes from the 147 isotope. The method of preparing the sample is described. (auth)

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6225 Argon^{39} Beta-Spectrum. A. R. Brosi, H. Zeldes, and B. H. Ketelle. Phys. Rev. 79, 902(1950) Sept. 1 (Letter to the editor).

A long-lived ($T^{1/2}$>15 yr) argon isotope, presumably A^{39} formed by the (n,p) reaction on K^{39} (a fission product) in the Oak Ridge pile, has been studied. The β-energy distribution was measured with a thin lens spectrometer and a Kurie plot was made. Results indicated a first-forbidden transition with a spin change of 2 and a maximum β energy of 0.565 ± 0.005 Mev. Attempts to detect γ rays indicated less than 0.1% branching with γ radiation more energetic then 300 kev.

6226 Beta-Decay of Ag^{111} and Spin-Orbit Coupling in Cd^{111}. Stig Johansson. Phys. Rev. 79, 896-7 (1950) Sept. 1 (Letter to the editor).

The gamma radiation of Cd^{111} resulting from the β decay of Ag^{111}, obtained by the decay of neutron-irradiated palladium, has been studied in a lens spectrometer by the photoelectrons emitted from a lead radiator. Gamma rays of energy 243 ± 2 and 340 ± 2 kev were found. A Fermi analysis was made of the β spectrum. A disintegration scheme is shown. The spins of the excited states of Cd^{111} are calculated from the internal conversion coefficients obtained by an analysis of the β spectrum. A term scheme is proposed and discussed in terms of the spin-orbit coupling model of nuclear shells.

6227 Cross-over Transitions in Ir^{194}, Ag^{110}, Cs^{134}. Richard Wilson. Phys. Rev. 79, 1004(1950) Sept. 15 (Letter to the editor).

According to the accepted decay schemes for Ir^{194}, Ag^{110}, and Cs^{134}, cross-over transitions might be expected. A search has been made for these transitions using the photo-disintegration of beryllium and deuterium as threshold detectors for high-energy γ radiation. The photoneutrons were detected by a Szilard Chalmers reaction in ethyl iodide under conditions in which the detection efficiency had been measured as a function of energy. The expected and observed intensities for various cross-over transitions are tabulated for comparison.

6228 Disintegration of Ru^{103}. Evani Kondaiah. Phys. Rev. 79, 891-2(1950) Sept. 1 (Letter to the editor).

A spectrographic study of Ru^{103} revealed electron peaks at 17, 36, and 474 kev. The lower two are ascribed to K and L conversion of a 40.0 ± 0.5-kev γ ray in metastable Rh^{103} and the highest to K conversion of a 498 ± 2-kev γ ray in the Rh. The β spectrum of Ru^{103} showed β components of 698 ± 10 kev and 217 ± 4 kev. A proposed decay scheme of Ru^{103} and Rh^{103} is illustrated.

6229 Disintegration Scheme of Scandium^{46}. B. N. Sorensen, B. M. Dale, and J. D. Kurbatov. Phys. Rev. 79, 1007(1950) Sept. 15 (Letter to the editor).

Conflicting values have been published for the branching ratio of the 0.36 and 1.49-Mev β emissions in Sc^{46}. A cloud chamber study revealed 11,000 tracks of β particles having energies below 0.36 Mev, 10 in the range 0.65 to 0.9 Mev, and 2 above 0.9 Mev. Allowing for scattering and for electrons from internal conversion, the upper limit for the 1.49-Mev β emission in Sc^{46} can be estimated as less than 0.05% of the 0.36-Mev β emission.

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6230 The Half-Life of the Isomeric State in ^{169}Tm. E. W. Fuller. Proc. Phys. Soc. (London) 63A, 1044 (1950) Sept. 1 (Letter to the editor).

The half-life of the short-lived Tm^{169} isomer has been measured using the differential type delayed coincidence recorder described by Bunyan et al (Proc. Phys. Soc. (London) 62A, 253(1949)). The value obtained was 0.658 ± 0.003 μsec.

6231 Internal Conversion Coefficients of Sc^{46}. M. L. Moon, M. A. Waggoner, and A. Roberts. Phys. Rev. 79, 905-6(1950) Sept. 1 (Letter to the editor).

A double-coil thin lens spectrometer was used to investigate the γ rays following the 0.36-Mev β spectrum of Sc^{46}. The experimentally determined values for the K + L + M unresolved conversion coefficients, together with the theoretical conversion coefficients for electric quadrupole radiation and magnetic dipole radiation in the K shell, are given. Assuming that the theoretical K value should be increased approximately 10% to correct for the contribution of L + M internal conversion and screening, the results classify both γ radiations as electric quadrupole. The predicted values for other types of radiations differ by a minimum factor of 1.6 from the experimental values. This result, together with those of recent angular correlation and polarization correlation experiments gives, for the nuclear levels of Ti^{46}, spins of 0, 2, 4 and equal parity.

6232 A New Selenium Isomer of 3.9-min Half-Life. A. Flammersfeld and Chr. Ythier. Z. Naturforsch. 5a, 401(1950) July. (Note, in German).

Neutron bombardment of a 5 mg/cm^2 selenium foil produced a new Se activity with a 3.9 ± 0.1-min half-life. The only emission consists of electrons of 0.09 ± 0.01 Mev. The new activity is observed when Se is irradiated either with fast neutrons from a Li + D source, or with fast or slow neutrons from a Be + D source. No mass assignment was made.

6233 On the Assignment of the 1.1-Hour Lead Isotope. Klaus Geiger. Z. Naturforsch. 5a, 401-3(1950) July (Note, in German).

A 1.1-hr activity, obtained by irradiating Pb with neutrons (or Tl with deuterons), has been attributed by Templeton et al (Phys. Rev. 72, 766(1947)) to Pb^{204*}, an isomer of the stable Pb^{204}. On various grounds, the present author questions this attribution (according to Mattauch's rule, even-even nuclei have no isomers; the excitation energy and half-life values give a spin of ~7 to 9 for Pb^{204*}). A test was made by irradiating Pb with Be + d neutrons slowed down by 3 cm paraffin; some of the lead samples were wrapped in Cd or In, and the corresponding decrease in effect was noted. Decreases ranging from 10 to 15% were observed, indicating that capture of slow neutrons, among which were thermal and In-resonance neutrons, was the real reaction involved. Since no stable Pb^{205} exists, the true process seems to be $Pb^{204}(n,\gamma)Pb^{205}$.

6234 The Radiations of Ce^{141} and Pa^{233}. M. S. Freedman and D. W. Engelkemeir. Phys. Rev. 79, 897-8(1950) Sept. 1 (Letter to the editor).

Pile-irradiated cerium oxide samples were purified (after the 33-hr Ce^{143} had decayed) by fluoride and iodate precipitations, including specific separation of praseodymium

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activity. Studies of the radiations of Ce^{141} resulted in essential confirmation of the findings of Shepherd (Research 1, 671(1948)) and indicated the source of the disagreement with the results of Ter-Pogossian et al (Phys. Rev. 76, 909(1949)) with respect to their reported 315-kev γ ray. The electron spectrum showed two allowed shape components with $E_0 = 0.581 \pm 0.003$ Mev and $E_0 = 0.442 \pm 0.003$ Mev although the ft-values (5.16×10^7 and 9.8×10^6, respectively) indicate empirically first-forbidden transitions. On the basis of both shapes being allowed, the intensities are 33 and 67%, respectively. Conversion lines at 102.9 and 138 kev, which arise in the K and L conversion of a γ ray of 145 kev, were found. No conversion electrons corresponding to a 137.1-kev γ ray appeared. The photoelectron spectrum of unpurified CeO_2 showed, in addition to the 145-kev γ ray and others of lower intensity, a strong 316-kev γ ray. It is believed that the latter is due to Pa^{233} resulting from the decay of a neutron-irradiated thorium impurity in the CeO_2. The electron spectrum of the impurity activity shows conversion lines at 288, 221, 192, 77.5, 61, and 50 kev. β-γ-coincidence measurements were made on Ce^{141} from which the internal conversion coefficient was deduced and a decay scheme (with spin values corresponding to the excited states) constructed. This is compared with the predicted level assignment based on the nuclear shell model proposed by Mayer (Phys. Rev. 78, 16(1950)).

6235 Radiations of Krypton^{85}. H. Zeldes, B. H. Ketelle, and A. R. Brosi. Phys. Rev. 79, 901-2(1950) Sept. 1 (Letter to the editor).

A detailed study of the β and γ radiations of Kr^{85} was made. The experimental β-energy distribution was obtained with a thin lens spectrometer. A Kurie plot indicates that the transition is first forbidden with a spin change of two and a parity change. Extrapolation of the straight line yields a maximum energy for the β transition of 0.695 ± 0.005 Mev. Scintillation spectrometer and lead absorption measurements of the γ radiation of long-lived fission krypton both indicate that the energy is 0.54 ± 0.02 Mev. Coincidence absorption data show that the γ ray is in coincidence with a 0.15 ± 0.02-Mev maximum energy β ray. The branching ratio in the decay of Kr^{85} was calculated from the coincidence data and the calibrated detection efficiency of the coincidence γ counter. It was found that Kr^{85} decays by emission of a 0.15-Mev β ray in coincidence with a 0.54-Mev γ ray in 0.65 ± 0.15% of the disintegrations.

6236 Radioactivities of Nb^{99}, Ta^{185}, and W^{185}, and the Relative (γ,n) and (γ,p) Cross Sections of Mo^{100}. R. B. Duffield, L. Hsiao, and E. N. Sloth. Phys. Rev. 79, 1011(1950) Sept. 15 (Letter to the editor).

A new isotope, Nb^{99}, was produced in enriched molybdenum (93% Mo^{100}) by 23-Mev betatron x-rays. The half-life was found to be 2.5 min, with decay by 3.2-Mev β^- emission. The ratio of (γ,p) to (γ,n) cross sections of Mo^{100}, at all x-ray energies used, was 100 times the calculated value. A $W^{186}(\gamma,n)$ reaction produced a 1.85-min isomer of W^{185} showing 75-kev conversion electrons. A $W^{186}(\gamma,p)$ reaction resulted in a 46-min Ta^{185} which decayed by 1.7 Mev β^- emission accompanied by conversion electrons appearing to be the same as those of W^{185}.

6237 Radioactivity from Enriched Isotopes of Cadmium. J. M. Cork, W. C. Rutledge, A. E. Stoddard, C. E. Branyan, and J. M. LeBlanc. Phys. Rev. 79, 738-9 (1950) Sept. 15.

By irradiating, in a pile, specimens of cadmium enriched in masses 108 and 114 instead of in its natural state, it is possible to interpret more positively the observed radioactivities and to evaluate the γ rays associated with each. Cd^{109}, produced by neutron capture in Cd^{108}, decays with a half-life of approximately 250 days by K-capture to Ag^{109} which then emits a strong γ ray of 87.5 kev. Cd^{115} is isomeric with half-lives of 54 hr and 42.6 days, both isomers decaying to In^{115} by β emission. The 54-hr activity yields γ rays in indium whose energies are 335.5, 343.7, 348.9, 369.3, 423.7, 451.9, 525.4, 559.1, and 713.1 kev. These γ energies fit well a proposed nuclear level scheme for In^{115}.

6238 The Specific Heat of Elemental Isotopes in Relation to Their Capacity for Atomic Disintegration. Victor Valenzuela Guardia. Minutes of Meetings and Proceedings of the Third Peruvian Congress of Chemistry, 150-56(1949) Oct. 17-23 (in Spanish).

The relationship between the specific heat of nuclides and their capacity for atomic disintegration is discussed. Tables are presented for radium, thorium, and actinium disintegration series, and for other elements. The specific heats are tabulated for reference in the discussion.

6239 Barrier Penetration and the Theory of the T + D Reaction. B. H. Flowers. Atomic Energy Research Establishment. AERE-T/R-538, June 1950. 20p.

The energy dependence and absolute magnitude of the cross section for the T + D reaction are described in terms of the exact wave functions of the Coulomb field and a complex reaction length is defined by the logarithmic derivative of the wave function on the reaction surface. Previous difficulties in the interpretation of the experiments are largely attributed to the failure of the WKB approximation. It is sufficient, but not necessary, to assume that the whole cross section is due to S-waves; but in either case the presence of strong spin-orbit coupling is indicated. (auth)

6240 Electron Diffusion in a Spherical Cavity; Technical Report No. 134. A. D. MacDonald and Sanborn C. Brown. M.I.T. Research Laboratory of Electronics, Aug. 3, 1949. 8p. (AEC File No. NP-1494.)

The diffusion equation for electrons in a nonuniform field is solved and the breakdown condition derived. The breakdown condition is expressed in such a manner that an effective characteristic diffusion length Λ_e is determined; the meaning of Λ_e expresses the equivalent characteristic diffusion length for uniform electric fields. From the experimental breakdown fields, Λ_e is determined and used to predict theoretical breakdown curves which are compared with experiment. (auth)

6241 High Frequency Gas Discharge Breakdown in Hydrogen; Technical Report No. 133. A. D. MacDonald and Sanborn C. Brown. M.I.T. Research Laboratory of Electronics, Aug. 3, 1949. 12p. (AEC File No. NP-1495.)

Electrical breakdown of hydrogen at high frequencies has been treated theoretically on the basis of the Boltzmann transport equation. Inelastic collisions are taken into account as a loss term in the Boltzmann equation and

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measured values of the ionization efficiency are used in the integral determining the ionization rate. The energy distribution function for electrons may be expressed in terms of the confluent hypergeometric function and simple exponentials. The ionization rate and diffusion coefficient are calculated using these distribution functions and kinetic theory, and are combined with the diffusion equation to predict breakdown electric fields. These predicted electric fields are compared with experimental values measured at 3000 Mc/sec. They are also compared with older measurements by other workers at frequencies ranging from 3 Mc/sec to 100 Mc/sec. The breakdown equation calculated from kinetic theory, using no gas discharge data other than the collision cross section measurements and involving no adjustable constants, predicts breakdown electric fields well within the limits of accuracy determined by these cross sections over a large range of pressure, container size and frequency of applied field. (auth)

6242 Nuclear Shell Structure and Nuclear Density. Max Born and L. M. Yang. Nature 166, 399(1950) Sept. 2 (Letter to the editor).

An explanation of the shell structure of nuclei is given. The closed shells are characterized by the following relation connecting the density $\rho(r)$ of a degenerate system of spin ½ particles to the numbers of particles with angular momentum quantum number l: $[r^3\rho(r)]_{max} = (2l+1)^3/24\,\pi^2$. The number of particles N(l) in the l-th shell is $N(l) = f(2l+3)^3$ where f depends on the form of $\rho(r)$. The following density distribution, constant in the interior and falling off as a Gaussian function near the surface, gives the shell numbers for $l \geq 3$:

$$\rho(r) = \rho_0 \qquad \text{for } r \leq R_0$$

$$= \rho_0 \exp\left[-\left(\frac{r-R_0}{a}\right)^2\right] \qquad \text{for } r > R_0$$

where ρ_0, a, and R_0 are determined empirically. For light nuclei, the central part of constant density does not exist. The pure Gaussian function

$$\rho(r) = \rho_0 \exp\left[-\left(\frac{r}{a}\right)^2\right]$$

gives correctly the first three shell numbers. The authors conclude that the thickness of the surface layer is not constant but is proportional to $A^{1/3}$ and that a central part of almost constant density exists owing to the effect of Coulomb repulsion.

6243 On De Broglie's Theory of Elementary Particles. H. Hönl and H. Boerner. Z. Naturforsch. 5a, 353-66(1950) July (in German).

De Broglie's "fusion method" permits a transition from the wave equation of an electron to particles of higher spins. In order to obtain information on the particles' properties, it is necessary to submit de Broglie's matrix systems to a complete reduction. This work is done here for the fusion step 3. The spins found are ½ and 3/2, while the ratio between the possible masses is 1/3. The magnetic moment of a particle is calculated for a special case. Without complementary assumptions, none of the particles of the step 3 can be identified as the proton. (auth)

6244 On the Quantization of Einstein's Gravitational Field Equations. F. A. E. Pirani and A. Schild. Phys. Rev. 79, 986-91(1950) Sept. 15.

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Weiss' method of quantization of field theories characterized by first-order Lagrangians can be carried out in a nonmetrical "amorphous" space, as was first stated by Bergmann and Brunings (Rev. Mod. Phys. 21, 480(1949)). The gravitational equations can be regarded as differential equations for the field variables $g_{\mu\nu}$ in an amorphous space and the quantization procedure can be applied to them. The gravitational field equations are written in canonical form, the Hamiltonian being a function of generalized coordinates, momenta, and velocities. This Hamiltonian is obtained using a method developed by Dirac for Lorentz invariant theories. (Dirac, Phys. Rev. 73, 1092(1948)).

6245 The S-Matrix in the Heisenberg Representation. C. N. Yang and David Feldman. Phys. Rev. 79, 972-8(1950) Sept. 15.

A method is described whereby the S-matrix can be formulated directly in the Heisenberg representation. This has the advantage over the customary formulation in the interaction representation in that the concepts of space-like surfaces and their normals need never be introduced. Quantum electrodynamics and the β formalism of charged mesons are greated as illustrative examples; in particular, it is shown that general rules for writing down the elements of the S-matrix for the latter case may be immediately inferred. In the second part of this paper, a covariant procedure, independent of the canonical formalism, is carried out for making the transition from the Heisenberg to the interaction representation and is applied to the case of neutral vector mesons interacting with nucleons through vector coupling and to the case of pseudoscalar mesons interacting with nucleons through pseudovector coupling. In this way, the S-matrix of the Heisenberg picture is identified with that of other authors. (auth)

6246 Stationary States in the Relativistic Quantum Theory of Wave Fields. W. Heisenberg. Z. Naturforsch. 5a, 367-73(1950) July (in German).

Since in a convergent relativistic quantum theory the S-matrix only can be taken, so far, as a reliable part of the mathematical formalism, it is shown how this matrix can be used for a derivation of stationary states of free particles or composite systems. The results so obtained are applied to the special case $S = T(T^*T)^{1/2}$ that has already been discussed in the author's earlier work (Z. Naturforsch. 5a, 251(1950)). Such properties as invariance and selection rules are studied for the foregoing special case, and it is shown that the formalism of phenomena involving small energy transfers leads to the old Hamiltonian formalism (a correspondence). Finally, the perturbation theory of the formalism is evolved up to the second approximation. (auth)

6247 A Theory of Differential Equations of Elementary Particles. K. Wildermuth. Z. Naturforsch. 5a, 373-81(1950) July (in German).

A deviation from the usual Hamiltonian formalism is unavoidable, if a nondivergent theory of elementary particles is to be constructed without introducing artificial cut-off procedures for the region of high momenta (which always brings about divergences in the quantum theory of wave fields). By introducing such cut-offs one abandons the valuable idea that, through the interaction of the totality of particles, any divergence will disappear of itself. Even in this preliminary stage of the theory, a few significant consequences arise. Heisenberg (Z. Naturforsch. 5a,

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251(1950)) has pointed out that, in the framework of the foregoing theory, integral-spin particles are aggregates of spinor particles; more specifically, it can be shown that a light photon does not consist of an electron and a

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positron, but rather of a proton and an antiproton, or of a similar pair. In a short final discussion, a way is shown that leads to a qualitative derivation of the Coulomb field. (auth)